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Editor:
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Assistant Editor:
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Metallurgical Editor:
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Mining Editor:
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Telephone: Trafalgar 6171 (Private Branch Exchange)
Telegraphic Address:, "Zacatecas, Rand London."

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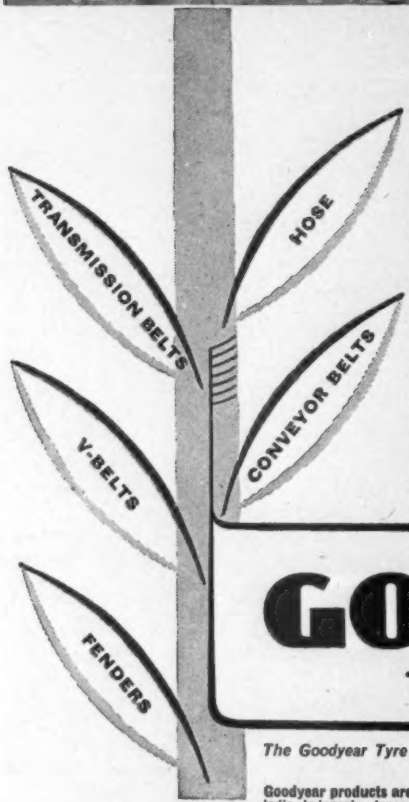
From the Goodyear family tree

LONG LIFE IN THE BALANCE



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GOODYEAR

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Continuous Casting of Steel Slabs

TWO PLANT ORDERS FOR DISTINGTON ENGINEERING

VERTICAL continuous casting plant for the production of large slabs is to be built by Distington Engineering Company, Limited, Workington, a branch of the United Steel Companies, Limited, on behalf of Richard Thomas & Baldwins, Limited, for installation in the Panteg Works of RTB. The machine will be built under licence from Concast A.G., Zurich, associates of Distington Engineering Company in the field of continuous castings.

The plant will be a single strand unit designed to cast up to 60 in. by 6 in. slabs. Steel qualities of various grades will be cast, especially stainless steel. Liquid steel will be lip poured from 35-ton and 15-ton ladles into a tundish, feeding direct into a water-cooled mould. After leaving the spray cooling chamber, the solidified slab will be withdrawn through two pairs of rolls, cut during its descent to lengths required, and discharged by basket, to a roller path.

Distington Engineering, in conjunction with Concast A.G. is also to build a vertical continuous casting plant for billets on behalf of Canara Workshops, Limited, Mangalore, India. The plant will be a single strand unit designed to cast from 2 in. square to 4 in. square billets, but equipped to cast 3.⅛ in. square billets initially. Provision is being made in the structure for the addition of a second strand at a later date. Main qualities to be cast will be silicon manganes steel.

Liquid steel will be lip poured from a 7-ton ladle into a tundish, feeding direct into a tubular copper mould. After leaving the spray cooling chamber the solidified billet will be withdrawn through two pairs of rolls and then bent to the horizontal and passed through a straightening device, to run out tables, where it will be cut to length. The machine will be shipped from this country in May, 1961.

VICKERS AND RACINE HYDRAULICS JOINT DEVELOPMENT

AGREEMENT has been reached between Vickers-Armstrongs (Engineers), Limited, and Racine Hydraulics & Machinery, Incorporated, of Racine, Winconsin, USA, whereby the two companies will jointly develop their hydraulic interests and manufacture and sell each other's hydraulic products on a world-wide basis.

Racine is one of the leading hydraulics manufacturers in North America. It produces equipment ranging from individual pumps and valves to complete power and package units working at high and low pressures. This equipment is incorporated in machine tools, presses, material handling equipment, and a wide range of other equipment.

ADDRESS of the National Society for Clean Air is now Field House, Breams Buildings, London, E.C.4 (telephone: CHAncery 5040).

Two New Plate Mills to Start Production

AFTER a trial run today (Friday), the plate mill at the South Durham Steel & Iron Company's new £50,000,000 works at Greatham, near West Hartlepool, is expected to go into operation on Monday. The mill, which is nearly half-a-mile long, is the biggest in Europe and probably in the world. It will have an initial output of 1,000 tons of finished plates a shift, and when it is working at full capacity will raise the company's production at its two West Hartlepool plants to 1,000,000 tons a year.

The new plate mill of the Consett Iron Company, Limited, at Consett (Co. Durham), will also shortly go into full production. The mill, built at a cost of £14,000,000, is nearly half-a-mile long, covers 70,000 sq. yds., and will employ over 400 men. The mill will be served by seven miles of railway track, and three trains a week consisting of 16 20-ton cars each will carry 1,000 tons of heavy fuel oil from the Shell installation at Jarrow to the plant at Consett.

Replying to comments by Mr. Sam Watson, the Durham miners' leader, that the use of oil by the steel industry could not make the future optimistic for men in the coal industry, a spokesman for Consett Iron Company said that the new rail service did not indicate a change of policy by the company. "I can say quite categorically that we are going to take no less coal from the NCB than we are taking now. And there is a distinct possibility that we shall want much more coal between 1965 and 1970."

Head Wrightson to Supply Cooling Towers for Mexico

THREE "Counterflo" induced draught cooling towers have been ordered from Head Wrightson Processes, Limited, a subsidiary of Head Wrightson & Company, Limited, by the turbine generator division of Associated Electrical Industries, Limited. The towers consist of three cells with two 20-ft. diameter fans and will each provide cooling water to one of the 3-33MW turbine generator sets which AEI is supplying to a new power station at Cuidad Juarez, in Mexico.

The cooling towers will reduce the temperature of the water, which circulates through the generator sets at the rate of 1,560,000 galls. an hour, from 89.4 deg. F. to 80 deg. F. Induced draught towers were selected for the operation after it was found that the site available and the duty involved made them a more economical proposition than other forms of cooling.

Orders Placed

Spencer Steelworks' Contract for AEI

SIX steelworks' process line drives, worth £339,000, for the new Spencer steelworks at Llanwern (Mon) of Richard Thomas & Baldwins, Limited, have been ordered from the motor and control gear division of Associated Electrical Industries, Limited. The lines consist of a $\frac{3}{16}$ in. hot rolled coil cut-up line together with a $\frac{1}{4}$ in. hot rolled coil cut-up line, a side trim, slit and recoil line, two fast cold coil cut-up lines, and a light gauge line. All the line drives are to be ready for commercial production by the end of September, 1961.

The ancillary equipment included in the contract includes all the a.c. auxiliary motors and associated control gear equipment. Each process line drive employs a d.c. Ward-Leonard system with closed-loop speed control.

LATEST TYPE of mobile army radar equipment has been ordered from EMI (Electronics), Limited, by the Swedish Government. It is the largest contract ever placed by Sweden for this type of equipment.

REPEAT ORDER for 300 four-cylinder "330" diesel engines for tractors has been placed with Henry Meadows, Limited, Sheffield, by Chamberlain Industries, Proprietary, Limited, of Western Australia.

FIFTH MACHINE at its Bridgend paper mills is to be installed by Wiggins Teape & Company, Limited. The new machine will be supplied by the Walmsley (Bury) Group, Limited, and the whole project will cost over £1,000,000. A number of new features will be incorporated in the machine, which will be capable of producing 15,000 tons of tissue a year.

ONIA-GEGI catalytic reforming plant has been ordered from Humphreys & Glasgow, Limited, London, S.W.1, for the Partington works of the North Western Gas Board. The contract is worth just over £200,000. The plant will take tail gas of high calorific value from the adjacent Carrington works of the Shell Chemical Company, Limited, and turn it into town gas. An output of 12,000,000 cu. ft. of town gas a day is expected, but substantial overload capacity will be built in, which could lift production by another 4,000,000 cu. ft. Refinery gas is expected to be taken in at a rate of 60,000 therms a day, and provision is made for the plant to use liquified petroleum gases as a standby.

Employers' Move on Pay Claim for Engineering Workers

WAGE negotiations covering 3,000,000 engineering workers are to begin on September 28, when discussions will start between the Confederation of Engineering and Shipbuilding Unions and the Engineering and Allied Employers' Federation, on the claim for a "general pay increase"—believed to be £1 a week, which would cost the industry £150,000,000 a year.

The last pay increase in engineering was in October, 1958. In April this year a 42-hour week was introduced, which set the pattern for a general reduction in hours in manufacturing industry.

US Machine Tool Orders Fall in July

MACHINE tool industry in the United States reported that net new orders for all types of machine tools in July fell to $42,000,000, the lowest monthly total since January, 1959. July orders compared with $55,000,000 in June and $63,400,000 in July, 1959. The National Machine Tool Builders' Association, in issuing the report, said the decline in new orders last month stemmed largely from reduced domestic demand for forming tools and a fall in foreign orders for metal cutting tools. However, for the first seven months of 1960, it noted, total new business rose to $377,900,000 from $368,700,000 in the same 1959 period.

Total despatches in July were $51,650,000 against $64,250,000 in June and $40,600,000 in July, 1959. For the first seven months of 1960, deliveries aggregated $389,050,000 against $289,750,000 in the corresponding period of 1959. The backlog of orders at the end of July was equal to 3.9 months against four months at the end of June, and five months early in 1960.

Vokes Plans to Manufacture in Common Market

AN "excellent and well-spread" order-book which should ensure full production for some months ahead is reported by Sir Ian Stewart-Richardson, chairman of Vokes, Limited, manufacturers of filtration and silencing equipment and specialized engineering products, of Guildford (Surrey). While the group manufactures and sells certain capital plant on its own account, he says, it also supplies initial equipment to a large range of manufacturers of capital goods, both for the home and export markets, and so far there would appear to be a continuing demand for these products.

Referring to the effects on the group's export business, should Britain continue to remain outside the Common Market, Sir Ian reveals that tentative steps are now under consideration for the group to manufacture certain of its products within that trade area. It is proposed to transfer the trading activities of the company to a new wholly owned subsidiary to be called Vokes, Limited, leaving the company solely as a holding company which will be renamed Vokes Group, Limited.

SLOWER OUTPUT RISE

INFORMATION so far received by the Treasury shows that Britain's industrial production in July was higher than in June. The Central Statistical Office announced on Tuesday that the production index for July, adjusted to take into account holidays and other seasonal factors, is expected to be 120-121 (1954 equals 100). The adjusted index for June was 120, the same as in May. In July last year it was 113.

In the first seven months of 1960 the index averaged 120 compared with 110 in the corresponding period of 1959. The Treasury said the increase in production had "very much slowed down in recent months."

Company News

BASTIAN & ALLEN

Heating Engineers Acquired by Parkinson Cowan

PARKINSON COWAN, LIMITED, has purchased all the ordinary shares of Bastian & Allen, Limited, electrical and mechanical heating equipment manufacturers, of Harrow (Middx). This acquisition, says Parkinson Cowan, is a natural extension of its interest in heating equipment for industrial buildings and processes which now embraces gas, oil and electrical appliances for domestic and industrial application. Bastian & Allen, founded in the early days of the electrical industry, makes electrode steam and hot water boilers, mobile steam cleaning equipment, and cooling systems for diesel engines.

Sales of Bastian & Allen have been steadily expanding over recent years and the company enjoys a sound export business, says Parkinson Cowan. In the first six months of this year, production has been running at a high level and the company has substantial orders in hand.

The chairman of the company, Mr. F. D. Campbell Allen; the managing director, Mr. S. A. Williams; the sales director, Mr. J. C. Edwards; the technical director, Mr. E. R. Weech, and the Scottish sales director, Mr. J. Jamieson, are all remaining in executive control of the business.

Wellman Smith Withdraws Bid for Gibbons (Dudley)

DIRECTORS of Wellman Smith Owen Engineering Corporation, Limited, announced last Friday that they were withdrawing their offer for the ordinary shares of Gibbons (Dudley), Limited, manufacturers of refractories and coal carbonizing plants, of Dudley (Worcs), in view of the offer by Wellington Tube Holdings, Limited, of 120s. per Gibbons £1 share.

The offer by Wellington Tube, reported last week, was recommended for acceptance by the Gibbons directors. They considered the terms of the Wellman Smith bid were inadequate.

H. & J. HILL (WILLENHALL), LIMITED—The interim dividend on account of 1960 is restored to 7½ per cent. from 5 per cent. Last year a total of 22½ (25) per cent. was paid.

RATCLIFFE'S SPRINGS, LIMITED—Group net profit for the year ended April 30, 1960, was £36,409 (£24,078) and the dividend is 15 per cent. A one-for-four scrip issue and the consolidation of 1s. shares into 5s. shares is proposed.

FOUNDRY EQUIPMENT & L. & Y. HOLDINGS, LIMITED—Net profit for the year ended March 31, 1960, fell from £29,553 to £18,351, after tax of £15,786 (£29,035). The dividend is reduced by 10 per cent. to 5 per cent.

MILES DRUCE & COMPANY, LIMITED—All the preference and ordinary share capital of Douglas Elliott & Company, Limited, steel stockholders, of Leeds, has been acquired for £220,000. Mr. D. Illingworth has joined the board of Miles Druce.

COLEY METALS, LIMITED—Negotiations are in progress for the acquisition of two companies which, in the directors' opinion, should be valuable assets to the group. The group's bankers have already indicated that they will grant the necessary financial facilities for these acquisitions.

WEAVER MANUFACTURING & ENGINEERING COMPANY, LIMITED, manufacturers of garage and degreasing plant, of Bedford—The Brussels firm of Appareillage Technique et Industriel, SA, which produces similar equipment to the company, has been acquired. The company's sales on the Continent are likely to be handled by the Belgian concern.

LODGE PLUGS, LIMITED—Present policy of the board is to improve production methods and develop new products for future growth, states the chairman, Mr. V. Martin-Jones. While this policy will have a beneficial effect in the long term, the initial effect will be to increase expenses, and he therefore expects the current year to be one of consolidation.

GEORGE KENT, LIMITED—Partnership has been entered into with the Italian firm of instrument makers, M. Tieghi & Company, for the company to acquire a majority holding of shares. Group net profit for the year ended April 2, 1960, was £307,061 (£226,388), and the dividend is maintained at 17 per cent. on capital increased by a three-for-eight rights issue.

KIRKSTALL FORGE ENGINEERING WORKS, LIMITED—The order book is full, reports Mr. R. F. Butler, the chairman. Difficulty in getting all the raw material wanted when the company needs it means that there are delays in deliveries to customers. Profit before tax for the year ended June 30, 1960, increased from £55,059 to £266,938 and the dividend is maintained at 12½ per cent.

WINGET, LIMITED—Final dividend of 10 per cent. on capital increased by a 75 per cent. scrip issue makes 13¾ (11¼) per cent. for the year ended March 31, 1960. Group net profit was £268,688 (£181,815), after tax of £131,923 (£98,866). Of the 648,000 ordinary 5s. shares offered at 6s. 3d. a share, 645,300 shares have been accepted representing over 99½ per cent. and the allotment of these shares has been confirmed.

STANDARD RANGE & FOUNDRY COMPANY, LIMITED—Interim dividend in respect of 1960 is raised from the equivalent of 3½ per cent. to 6½ per cent. on a capital increased from £90,000 to £250,000. The equivalent total for 1959 was 18½ per cent. The company's shares were marketed last October. Mr. C. J. B. Pratt, the

chairman, reports that turnover figures continue in excess of the previous year and that the order-book is well filled.

ROYSTON INDUSTRIES, LIMITED—A one-for-one rights issue is to be made at 1s. 1½d. per 1s. share. Mr. E. R. Summers, the chairman, states that progress in almost every phase of affairs is shown in the current year, the benefits of which will accrue in the year to end in December, 1961. For that year the board foreshadows a substantial increase in activities and profits, with a dividend of not less than 20 per cent. on the increased capital.

ELLIOTT-AUTOMATION, LIMITED—The offer for the issued share capital of the Rheostatic Company, Limited, has been accepted by the holders of more than 92 per cent. of the preference and of more than 93 per cent. of the ordinary stock. The increase in the company's authorized share capital has been approved and quotation has been granted for the new shares to be issued under the offer, which has therefore become unconditional.

TUNNEL PORTLAND CEMENT COMPANY, LIMITED—The directors are confident that over a long term the demand for cement in the UK will continue to expand, and are considering proposals to increase productive capacity and the further replacement of plant in order to reduce fuel consumption. Over the next few years between £2,500,000 and £3,000,000 will be spent on improvements, which it is expected can be financed from the company's own resources.

GRESHAM DEVELOPMENTS, LIMITED, Hanworth (Middx)—The company has amalgamated with Lion Electronic Developments, Limited, Feltham (Middx), to form a new company, Gresham-Lion Electronics, Limited, Gresham House, Twickenham Road, Hamworth (Middx) (telephone: FELtham 2271). Directors are Mr. John P. Coleman, Mr. J. A. Clegg, and Dr. C. B. Speedy. The reorganization has been effected to eliminate overlapping interests.

WAGON REPAIRS, LIMITED—Due to the curtailment of British Railways work in the earlier part of the year ended March 31, 1959, several workshops and many outstation depots were closed. Later in the year the private contractors were requested to step up output to cope with the steadily increasing volume of wagons awaiting repair. Activities in connection with privately owned rail vehicles and rail-tank cars are being well maintained, the directors state, and manufacturing departments and foundries are yielding a satisfactory surplus.

BRAITHWAITE & COMPANY ENGINEERS, LIMITED—Mr. J. H. Humphryes, the chairman, states that the company will not receive full benefit from its more favourable structural steel contract position in the current year. It may not be until 1961-62 that the benefit in terms of profit appears in the accounts, therefore the profit margin for 1960-61 may not cover the present rate of ordinary dividend, which for the year ended May 31, 1960, is maintained at 8 per cent. with a net capital distribution of 2 (same) per cent. Group net profit was £45,706 (£76,222).

AFRICAN METALS CORPORATION, LIMITED (AMCOR)—Sales in the year ended March 31, 1960, rose from £5,500,000 to £7,500,000, with exports increasing by £1,700,000 to £4,200,000. The net profit, after tax, rose from £422,000 to £929,000. A rights issue of 700,000 ordinary 10s. shares is planned, which would mean a ratio of four new shares for every 25 held. The dividend on the increased capital is 1s. 9d. The installation of additional electric furnace capacity to cope with the increasing demand for ferro-alloys is being considered. Production of ferro-alloys last year increased from 69,000 to 96,000 tons.

More Iron Ore Through South Wales Ports

IMPORTS of iron ore through the South Wales ports increased by 115,000 tons to 475,821 in the four weeks ended August 14, while iron and steel imports rose by 39,000 to 48,673 tons. Figures published by the British Transport Commission show also that imports of non-ferrous ores rose by 37,000 to 39,967 tons. Exports of iron and steel goods in the four weeks fell by 23,000 tons to 21,585 tons, while exports of tinplate also fell by 3,000 tons to 8,428 tons.

Iron-ore arrivals for the whole of the year so far have jumped by 791,594 to 3,206,024 tons. Iron and steel goods have risen by 153,331 to 246,042 tons and non-ferrous ores by 67,377 to 201,385 tons. Exports of tinplate have gone up by 16,455 to 317,921 tons, while iron and steel exports have dropped by 103,247 to 236,001 tons and coal and coke by 65,126 to 1,552,629 tons. Foreign exports of coal rose from 667,379 to 726,759 tons.

Total traffic through the various ports for the four weeks ended August 14, with figures for the corresponding period last year in parentheses, are: Newport 204,957 (215,189) tons; Cardiff 190,300 (156,579) tons; Barry 108,665 (95,342) tons; Port Talbot 331,850 (226,083) tons; Swansea 621,873 (568,546) tons; Penarth 24,162 (23,785) tons; Lydney 2,546 (819) tons.

£800,000 Tube Mill Order for Head Wrightson

CONTRACT for a complete seamless tube mill for Tubes, Limited, Desford, near Leicester, a member of the Tube Investments, Limited, group, has been awarded to the Head Wrightson Machine Company, Limited, a subsidiary of Head Wrightson & Company, Limited. The order, valued at approximately £800,000, follows a previous order for a similar mill.

The seamless tube mill consists of specialized equipment for producing hot finished alloy steel tubes between 1½-in. and 6-in. outside diameter to very close tolerances. The tubes will chiefly be made in those grades of steel used for the production of ball and roller bearing races, but the mill is also equally suitable for making medium- and thick-walled tubing in low or high carbon steels for a variety of other purposes where accuracy is important.

Hobbs Transmission Link with Westinghouse

HALF-INTEREST in the £100,000 capital of Hobbs Transmissions, Limited, Leamington Spa, has been acquired by the Westinghouse Brake & Signal Company, Limited, London, N.1. Hobbs's small development and prototype factory will continue its work and it is the intention to manufacture its range of transmissions, for small popular cars up to shunting locomotives, at Westinghouse plants.

The directors of Hobbs, who continue in office, are Maj. C. J. P. Ball, chairman, Mr. H. F. Hobbs, technical director, and Mr. B. L. Oldfield.

IRON AND STEEL TRADE

COMPARED with the position a year ago, considerable increases in outputs of steel ingots and castings, even during the period affected by holidays, have been recorded in most parts of the country. On the North East Coast production of pig-iron has almost doubled, and although the August figures are bound to reflect some reduction in outputs of finished steel, the seasonal average is high. Reserves of finished materials held at works at the end of the second quarter were considerable, and now that full production has been resumed in all sections of the industry, the state of the order-books, particularly for structural shapes and plates, is so reassuring that capacity outputs will have to be achieved during the next four months.

Pig-iron

Production of basic pig-iron, which comprises a high percentage of overall output, is at substantial levels, and the steelworks are able to obtain all the supplies they require for their high rate of ingot production. In the foundry grades of pig-iron, also, adequate tonnages are available and no difficulty is found in fulfilling present demands.

Ferro-alloys

There is a good demand for most alloys. Although still unchanged in price, ferro-tungsten is slightly more active, and moderate support is given to ferro-vanadium and ferro-molybdenum. Both the 75 per cent. Si and 45 per cent. Si grades of ferro-silicon are active, and there is a fair demand for ferro-chrome. Steady attention is given to calcium silicide, and ferro-manganese is well supported. The demand for ferro-niobium is at a good level, and ferro-titanium is quite active. Chromium metal is in fair request, and silicon metal is of slight interest.

Semi-finished Steel

Re-rolled products continue in good demand and the mills are obtaining substantial outputs of small bars, light sections, and reinforcing rods. Only the shortage of suitable labour prevents increased production. Adequate supplies of steel semis in the mild-steel qualities are held in stock by re-rollers, and some of them have found it necessary to curtail deliveries from home steelworks until their stocks have been reduced. The re-rollers requiring high carbons and special quality steels are not so favourably placed for supplies.

Finished Steel

Demand for sections and joists is maintained, and the more popular sizes have now virtually disappeared from current rolling programmes. Capacity is still available for sections less frequently rolled, but the number is being reduced week by week, as makers continue to accumulate tonnage which takes up available production for some weeks ahead. With heavy order-books for plates of all descriptions and particularly the lighter thicknesses, makers are only accepting approved orders for forward delivery. Stockholders are experiencing an increase in demand, especially for the more popular sizes of angles and channels, for which the makers are having to quote extended rolling dates.

The market for cold-reduced sheets is pressed by consumers, despite the fact that makers are already overloaded, but the position is eased to some extent by the fact that supplies are being received from both the Continent and America. Good commercial quality bright drawn bars and cold-drawn strip are in fair supply, adequate supplies of the necessary raw material being available, and hot-rolled black sheets and strip are also available, but alloy and free-cutting bright drawn bars are in short supply. Orders for flat and corrugated galvanized sheets can still be placed, although certain thinner gauges are more difficult to obtain than others.

Despite the recent improvement in demand there is still capacity available for further tonnage in many of the constructional shops and further orders, even at the very keen prices ruling at the present time, would be appreciated to reduce overheads. Unfortunately, the demand for colliery requirements shows no immediate signs of improvement, and makers would welcome further orders for arches, pit props, light rails, etc., to boost their present production programmes.

Welsh Steelworkers End Strike

STRIKE by more than 500 craftsmen, fitters and electricians at the Steel Company of Wales, Limited, works at Velindre, Swansea, ended last Sunday. The men struck the Saturday before over the suspension of a man who, a company official said, refused to do a job when told. For two or three days the craftsmen had been working to rule.

The official said, "The craftsmen asked if the men could go back to work. The company agreed that the man whose suspension caused the strike should also start work, provided he agreed to carry out the duties allocated to him by the management." The men were still working to rule, it was stated.

Notice of intention to strike on September 8 was given at the weekend by 1,200 craftsmen employed at the company's modern tinplate works at Trostre, Llanelly, and Velindre, Swansea. The dispute is over rates of pay.

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As there are still six weeks left of the financial year, it is expected that the final total will be about 1,130,000 tons—more than 200,000 tons above the previous best.

chairman, reports that turnover figures continue in excess of the previous year and that the order-book is well filled.

ROYSTON INDUSTRIES, LIMITED—A one-for-one rights issue is to be made at 1s. 1½d. per 1s. share. Mr. E. R. Summers, the chairman, states that progress in almost every phase of affairs is shown in the current year, the benefits of which will accrue in the year to end in December, 1961. For that year the board foreshadows a substantial increase in activities and profits, with a dividend of not less than 20 per cent. on the increased capital.

ELLIOTT-AUTOMATION, LIMITED—The offer for the issued share capital of the Rheostatic Company, Limited, has been accepted by the holders of more than 92 per cent. of the preference and of more than 93 per cent. of the ordinary stock. The increase in the company's authorized share capital has been approved and quotation has been granted for the new shares to be issued under the offer, which has therefore become unconditional.

TUNNEL PORTLAND CEMENT COMPANY, LIMITED—The directors are confident that over a long term the demand for cement in the UK will continue to expand, and are considering proposals to increase productive capacity and the further replacement of plant in order to reduce fuel consumption. Over the next few years between £2,500,000 and £3,000,000 will be spent on improvements, which it is expected can be financed from the company's own resources.

GRESHAM DEVELOPMENTS, LIMITED, Hanworth (Middx)—The company has amalgamated with Lion Electronic Developments, Limited, Feltham (Middx), to form a new company, Gresham-Lion Electronics, Limited, Gresham House, Twickenham Road, Hamworth (Middx) (telephone: FELtham 2271). Directors are Mr. John P. Coleman, Mr. J. A. Clegg, and Dr. C. B. Speedy. The reorganization has been effected to eliminate overlapping interests.

WAGON REPAIRS, LIMITED—Due to the curtailment of British Railways work in the earlier part of the year ended March 31, 1959, several workshops and many outstation depots were closed. Later in the year the private contractors were requested to step up output to cope with the steadily increasing volume of wagons awaiting repair. Activities in connection with privately owned rail vehicles and rail-tank cars are being well maintained, the directors state, and manufacturing departments and foundries are yielding a satisfactory surplus.

BRAITHWAITE & COMPANY ENGINEERS, LIMITED—Mr. J. H. Humphryes, the chairman, states that the company will not receive full benefit from its more favourable structural steel contract position in the current year. It may not be until 1961-62 that the benefit in terms of profit appears in the accounts, therefore the profit margin for 1960-61 may not cover the present rate of ordinary dividend, which for the year ended May 31, 1960, is maintained at 8 per cent. with a net capital distribution of 2 (same) per cent. Group net profit was £45,706 (£76,222).

AFRICAN METALS CORPORATION, LIMITED (AMCOR)—Sales in the year ended March 31, 1960, rose from £5,500,000 to £7,500,000, with exports increasing by £1,700,000 to £4,200,000. The net profit, after tax, rose from £422,000 to £929,000. A rights issue of 700,000 ordinary 10s. shares is planned, which would mean a ratio of four new shares for every 25 held. The dividend on the increased capital is 1s. 9d. The installation of additional electric furnace capacity to cope with the increasing demand for ferro-alloys is being considered. Production of ferro-alloys last year increased from 69,000 to 96,000 tons.

More Iron Ore Through South Wales Ports

IMPORTS of iron ore through the South Wales ports increased by 115,000 tons to 475,821 in the four weeks ended August 14, while iron and steel imports rose by 39,000 to 48,673 tons. Figures published by the British Transport Commission show also that imports of non-ferrous ores rose by 37,000 to 39,967 tons. Exports of iron and steel goods in the four weeks fell by 23,000 tons to 21,585 tons, while exports of tinplate also fell by 3,000 tons to 8,428 tons.

Iron-ore arrivals for the whole of the year so far have jumped by 791,594 to 3,206,024 tons. Iron and steel goods have risen by 153,331 to 246,042 tons and non-ferrous ores by 67,377 to 201,385 tons. Exports of tinplate have gone up by 16,455 to 317,921 tons, while iron and steel exports have dropped by 103,247 to 236,001 tons and coal and coke by 65,126 to 1,552,629 tons. Foreign exports of coal rose from 667,379 to 726,759 tons.

Total traffic through the various ports for the four weeks ended August 14, with figures for the corresponding period last year in parentheses, are: Newport 204,957 (215,189) tons; Cardiff 190,300 (156,579) tons; Barry 108,665 (95,342) tons; Port Talbot 331,850 (226,083) tons; Swansea 621,873 (568,546) tons; Penarth 24,162 (23,785) tons; Lydney 2,546 (819) tons.

£800,000 Tube Mill Order for Head Wrightson

CONTRACT for a complete seamless tube mill for Tubes, Limited, Desford, near Leicester, a member of the Tube Investments, Limited, group, has been awarded to the Head Wrightson Machine Company, Limited, a subsidiary of Head Wrightson & Company, Limited. The order, valued at approximately £800,000, follows a previous order for a similar mill.

The seamless tube mill consists of specialized equipment for producing hot finished alloy steel tubes between 1¼-in. and 6-in. outside diameter to very close tolerances. The tubes will chiefly be made in those grades of steel used for the production of ball and roller bearing races, but the mill is also equally suitable for making medium- and thick-walled tubing in low or high carbon steels for a variety of other purposes where accuracy is important.

Hobbs Transmission Link with Westinghouse

HALF-INTEREST in the £100,000 capital of Hobbs Transmissions, Limited, Leamington Spa, has been acquired by the Westinghouse Brake & Signal Company, Limited, London, N.1. Hobbs's small development and prototype factory will continue its work and it is the intention to manufacture its range of transmissions, for small popular cars up to shunting locomotives, at Westinghouse plants.

The directors of Hobbs, who continue in office, are Maj. C. J. P. Ball, chairman, Mr. H. F. Hobbs, technical director, and Mr. B. L. Oldfield.

IRON AND STEEL TRADE

COMPARED with the position a year ago, considerable increases in outputs of steel ingots and castings, even during the period affected by holidays, have been recorded in most parts of the country. On the North East Coast production of pig-iron has almost doubled, and although the August figures are bound to reflect some reduction in outputs of finished steel, the seasonal average is high. Reserves of finished materials held at works at the end of the second quarter were considerable, and now that full production has been resumed in all sections of the industry, the state of the order-books, particularly for structural shapes and plates, is so reassuring that capacity outputs will have to be achieved during the next four months.

Pig-iron

Production of basic pig-iron, which comprises a high percentage of overall output, is at substantial levels, and the steelworks are able to obtain all the supplies they require for their high rate of ingot production. In the foundry grades of pig-iron, also, adequate tonnages are available and no difficulty is found in fulfilling present demands.

Ferro-alloys

There is a good demand for most alloys. Although still unchanged in price, ferro-tungsten is slightly more active, and moderate support is given to ferro-vanadium and ferro-molybdenum. Both the 75 per cent. Si and 45 per cent. Si grades of ferro-silicon are active, and there is a fair demand for ferro-chrome. Steady attention is given to calcium silicide, and ferro-manganese is well supported. The demand for ferro-niobium is at a good level, and ferro-titanium is quite active. Chromium metal is in fair request, and silicon metal is of slight interest.

Semi-finished Steel

Re-rolled products continue in good demand and the mills are obtaining substantial outputs of small bars, light sections, and reinforcing rods. Only the shortage of suitable labour prevents increased production. Adequate supplies of steel semis in the mild-steel qualities are held in stock by re-rollers, and some of them have found it necessary to curtail deliveries from home steelworks until their stocks have been reduced. The re-rollers requiring high carbons and special quality steels are not so favourably placed for supplies.

Finished Steel

Demand for sections and joists is maintained, and the more popular sizes have now virtually disappeared from current rolling programmes. Capacity is still available for sections less frequently rolled, but the number is being reduced week by week, as makers continue to accumulate tonnage which takes up available production for some weeks ahead. With heavy order-books for plates of all descriptions and particularly the lighter thicknesses, makers are only accepting approved orders for forward delivery. Stockholders are experiencing an increase in demand, especially for the more popular sizes of angles and channels, for which the makers are having to quote extended rolling dates.

The market for cold-reduced sheets is pressed by consumers, despite the fact that makers are already overloaded, but the position is eased to some extent by the fact that supplies are being received from both the Continent and America. Good commercial quality bright drawn bars and cold-drawn strip are in fair supply, adequate supplies of the necessary raw material being available, and hot-rolled black sheets and strip are also available, but alloy and free-cutting bright drawn bars are in short supply. Orders for flat and corrugated galvanized sheets can still be placed, although certain thinner gauges are more difficult to obtain than others.

Despite the recent improvement in demand there is still capacity available for further tonnage in many of the constructional shops and further orders, even at the very keen prices ruling at the present time, would be appreciated to reduce overheads. Unfortunately, the demand for colliery requirements shows no immediate signs of improvement, and makers would welcome further orders for arches, pit props, light rails, etc., to boost their present production programmes.

Welsh Steelworkers End Strike

STRIKE by more than 500 craftsmen, fitters and electricians at the Steel Company of Wales, Limited, works at Velindre, Swansea, ended last Sunday. The men struck the Saturday before over the suspension of a man who, a company official said, refused to do a job when told. For two or three days the craftsmen had been working to rule.

The official said, "The craftsmen asked if the men could go back to work. The company agreed that the man whose suspension caused the strike should also start work, provided he agreed to carry out the duties allocated to him by the management." The men were still working to rule, it was stated.

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Obituary

Sir Lionel Lowe—Former Member of the NCB

THE death occurred on Tuesday of Sir Lionel Lowe, former member of the National Coal Board from 1946 to 1951. He was 62. Educated at Westminster and Cambridge, he was commissioned in the RGA in 1917 and served in France and Belgium. He afterwards served his articles with Thomson, McLintock & Company, Limited, and in 1935 was made a partner in the firm.

In 1942 he was appointed a Director of Finance, Ministry of Fuel and Power. In 1946 he was one of those invited by Mr. Shinwell, Minister of Fuel and Power, to join the National Coal Board under the chairmanship of Lord Hyndley. He served until 1951. He was appointed a director of Milford Docks Company, Limited, in 1954, and was knighted in 1951.

MR. WILLIAM WALLACE

THE death occurred last week of Mr. William Wallace, manager of Granville Colliery, Woodville (Staffs), and president of the South Midland branch of the National Association of Colliery Managers from 1945-46. He was 55.

A native of Tynemouth (Northumberland), Mr. Wallace attended Durham University and served his apprenticeship in the mining industry at Seghill Colliery under Maj. Stanley Walton-Brown (who died last month. He rose from deputy overman to under-manager, obtaining his manager's certificate in 1933. In 1940 Mr. Wallace joined the former Hall's Collieries, Limited, group, taking over at Bretby Colliery at a time when that pit was experiencing difficulties. Under his guidance, Bretby became one of the few collieries in the country that had turned 2 tons per manshift consistently after reaching that target.

Early in 1947, Mr. Wallace became manager of Bretby and Cadley Hill collieries, and in the middle of the same year was appointed manager at Swadlincote Colliery. He returned to the managership of Bretby and Cadley Hill collieries in 1950. After a period as manager at the Bretby pit in 1952 he took over his final position at Granville Collieries in 1956, where extensive progress, particularly in the field of mechanical development, took place under his leadership.

An all-round sportsman during his youth, he played rugby for his university and was a member of the Northumberland County XV for 10 years and an England reserve player between 1923 and 1928.

Works manager of the Clyde Crane & Engineering Company, Limited, Mossend (Lanarkshire), Mr. STEWART ARNOTT DAVIDSON died recently. He had been associated with the company, which he joined as a fitter, for over 30 years.

The death has occurred at the age of 80 of Mr. EDWARD SWINNEY, chairman of Swinney Bros., Limited, engineers and ironfounders, of Morpeth (Northumberland). Mr. Swinney started his apprenticeship in 1895, joining the board of Swinney Bros. in 1923.

The death occurred last week of Mr. HAROLD TAYLOR, for 20 years chief engineering inspector of J. Blakeborough & Sons, Limited, engineers and valve makers, of Brighthouse (Yorks). On his retirement in November he had completed 40 years' service with the company.

Co-founder of the Lanchester Motor Company, Limited, Mr. FRANK LANCHESTER has died at the age of 90. He founded the company with his brother in 1899 and was sales director and later managing director. He relinquished his managerial responsibilities when Lanchester Motor was acquired by BSA in 1931 and became a director on the new board.

The death has occurred of Mr. WILLIAM HORACE BECKINGHAM, the Newcastle-upon-Tyne shipowner and coal exporter. He was 91. He was associated for many years with the coal exporting firm of T. T. Pascoe, Limited, from whose board he retired in 1949. Before his retirement 12 years ago Mr. Beckingham was a director of Furness Withy & Company, Limited. He continued to serve on two of the boards of that company's subsidiaries, and was also a director of Cairns Noble & Company, Limited.

Following an accident at Hafodyrynys Colliery (Mon), Mr. JOHN EVANS, a miner, died at the Royal Gwent Hospital. He was 52.

Over 1,000 Restrictive Trade Pacts Abandoned

NEARLY half the agreements on the Register of Restrictive Trading Agreements have now been abandoned, varied to remove their restrictions, or declared contrary to the public interest. Figures published on Tuesday by the Registrar show that on August 1 more than 1,030 of the 2,300 agreements on the register had been abandoned or had all restrictions removed from them.

The great majority of cases have been abandoned before reference to the court. Of the 63 cases that have been decided by the court only 11 were defended and in only three of these, which included water tube boilers, and black bolts and nuts, were one or more restrictive clauses found not contrary to the public interest.

THE FIFTH GATT Tariff Conference opened yesterday (Thursday) at the Palais des Nations, Geneva. Some 200 delegates from the 37 member nations and from seven associated countries are attending the first phase of the conference.

APPROXIMATELY 70 per cent. of the 10,000 male employees of the South Durham Steel & Iron Company, Limited, will be contracted out of the State Pension Scheme. This will apply to all male members of the company's pension scheme whose average weekly earnings are at least £12.

PUBLIC INQUIRY has been ordered by the Minister of Power into proposals by the Central Electricity Generating Board to build a power station—which would be the largest in Europe—in the Nottinghamshire green belt at Holme Pierrepont. The inquiry will take place at Radcliffe-on-Trent on November 22. Since the proposals were first made known there have been vigorous protests against them.

Bid for William Foster

W. H. ALLEN'S £1,500,000 OFFER FOR PUMP BUSINESS

CASH offer worth nearly £1,500,000 has been made by W. H. Allen, Sons & Company, Limited, mechanical, hydraulic and electrical engineers, of Bedford, for the £79,905 preference and £343,845 ordinary capital of William Foster & Company, Limited, Lincoln, which, with its subsidiary, Gwynnes Pumps, Limited, designs and manufactures a wide range of pumping machinery and carries out contract work associated with this.

The offer is 20s. for each ordinary 5s. share and 20s. for each 6 per cent. cumulative preference £1 share. In Wednesday's Stock Exchange trading the ordinary shares were quoted at 13s. 10½d. and the preference at 18s. 9d. ex dividend.

The directors of William Foster, who intend to accept the offer in respect of their own holdings, state that they consider the terms to be fair and reasonable, and unanimously recommend their shareholders to accept. It is intended that both businesses will continue as at present and the position of staff and employees will be unchanged.

Big Rise in Austrian Pig-iron and Steel Production

DURING the first half of this year, a record 1,080,000 metric tons of pig-iron was produced in Austria. This figure is higher by almost 31 per cent. than that for the corresponding period of 1959. With the production of the second Linz-Donawitz (LD) process steelworks of the State VOEST steel concern and the restarting of the Sankt-Andrä-Wördern works by Alpine-Montan Gesellschaft, raw steel output rose by 41 per cent. over the period to 1,520,000 metric tons.

Production of rolled steel went up by 28 per cent. to a half-yearly total of 1,030,000 tons. In the raw steel sector, the Austrian LD process now accounts for 56.6 per cent. of total production. From the rolling industry it is announced that order-books are good and producers sold out for all usual dimensions until well into 1961.

During the first half of this year Austrian foundries produced 95,000 metric tons of castings, compared with 83,000 tons in the same period last year. Output for the whole of 1960 is expected to pass the record level reached in 1957. Over the same period cast steel output rose from 7,500 to 10,100 tons. Malleable iron castings production in the first six months of this year reached 4,600 (3,700) tons, and that of light metal castings 2,400 (2,200) tons.

Austria's coal mining industry made deliveries of about 2,735,300 metric tons during the first half of this year. This figure, at the same level as previous years, includes increased sales to power stations and the railways, offset by lower sales to industry, gasworks, and households.

FURTHER REDUCTIONS in the basic prices of wrought titanium were announced by Imperial Chemical Industries, Limited, on Wednesday. The cuts, which will affect deliveries from November 1, range from 15 per cent. for rod extrusions, and commercially pure sheet, to 10 per cent. for plate, wire, and alloy sheet.

Firth Cleveland Expands in Australia

CHANGES made in the Firth Cleveland, Limited, group's Australian companies reflect, it is stated, the great increase in the quantity and diversity of the group's Australian activities during the past few years. Simmonds Aerocessories, Pty, Limited, has been renamed Firth Cleveland, Pty., Limited, and Mr. J. R. Burt has been elected chairman.

He is chairman of Caterpillar of Australia, Pty., Limited, and a director of many leading Australian financial and industrial concerns. He is also to become chairman of a new company, Firth Cleveland Pumps, Pty., Limited, which has been formed to promote the sale of Firth Cleveland single and multi-stage self-priming centrifugal pumps and Sabre Jet water systems, which are believed to have a great potential in Australia.

Mr. Burt has also been elected chairman of Landmaster, Pty., Limited, whose principal product, the Landmaster 150 rotary cultivator, has recently been strongly recommended to farmers by the Australian Scientific International Advisory Council.

Firth Cleveland, Pty., will be responsible for the manufacture and marketing in Australia of Simmonds self-locking nuts, Simmonds Spire Speed fastenings, Surform hand tools and power tool attachments, and Surcut power tool attachments. The company will also manufacture Landmaster and Gardenmaster cultivators, and Firth Cleveland pumps and water systems for Landmaster, Pty., and Firth Cleveland Pumps, Pty. These products will be handled by a special division of the company.

Mr. J. Hanford Stevens will continue as managing director of all three companies.

Rankin & Blackmore Agreement with Dutch Pump Makers

NEGOTIATIONS will shortly be completed on an agreement between Rankin & Blackmore, Limited, marine engineers, of Greenock, and Stork & Company, NV, Gebr, Holland, for the assembly of Stork circulating pumps. The pumps will be used for both land and marine purposes.

Mr. T. W. D. Abell, a director of Rankin & Blackmore, said that at the beginning the company would import the parts from Holland and assemble them at Greenock. "But if the demand is as big as we expect we will eventually manufacture the pumps here," he said. It was part of a plan, he explained, to diversify the activities of Rankin & Blackmore.

Coalfield News

Pit Transfers Worry Durham Miners

BAN on all overtime at Whitburn Colliery (Co. Durham) was imposed at a meeting of Marsden Miners' Lodge on Sunday until negotiations with the National Coal Board over the transfer of 140 miners to other pits in the Area have reached a "satisfactory conclusion." The colliery is scheduled as "uneconomic" and the NCB proposes to transfer about 10 per cent. of the 1,450 men employed there to Wearmouth, Wardley, Washington, and Westoe collieries. The 140 men to be transferred are at the moment piece-workers, but after the transfer they would become datal hands, with a resultant drop in wages.

The chairman at the lodge meeting, Mr. Leslie Hannah, said they could not understand why the board wanted to close two of the most productive districts in the colliery. "The men who are to be moved produced 2,200 tons of coal last week," he said. "If they move as datal hands they will become non-productive."

The leader of another NUM lodge in the division, Mr. Thomas Peel, chairman of Hedley Lodge, denied at the weekend rumours that Hedley Drift was about to close. Last year the NCB assured Prudhoe Urban Council that Hedley would continue production until 1967, when reserves became exhausted.

Mr. BART ELLIOTT, weighman at Murton Colliery (Co. Durham), where he has worked for the past 34 years, has retired at the age of 65.

GOLF COMPETITION for employees of the West Midlands Divisional Coal Board is to be held at Bloxwich course tomorrow (Saturday). It will be a medal round over 18 holes.

ONE OF TWO MINERS who were trapped for six hours by a roof fall at Markham Main Colliery (Yorks) on Thursday of last week died in Doncaster Royal Infirmary. He was Mr. George Albert Nelthorpe (31), a pan turner.

OVERALL PRODUCTIVITY in the Durham Divisional Coal Board in the first 33 weeks of this year averaged 21.85 cwt. per manshift against 21.36 cwt. in the same period a year ago. Output at the face was 64.49 (62.66) cwt. per manshift.

UNOFFICIAL STRIKE of 150 miners at Ramcroft Colliery (Derbyshire) at the weekend cost the pit 1,000 tons of coal. The men came out on strike over a wage complaint, but returned to normal working on Monday without having resolved the matter.

SCOTTISH MINERS' bowls championship, organized by the Scottish Coal Industry Social Welfare Organization, drew an entry of 1,189 competitors, representing 129 clubs. The singles championship was won by Mr. T. Arnott, of Shotts Miners' Welfare Club.

MINERS who have completed a reasonable service in the coal industry should not be forced to give up their NCB houses if they take other jobs, thinks the Derbyshire branch of the NUM. A request has been sent to the NCB that it should act on the branch decision.

AMENDMENT to the Conciliation Agreement, which binds the National Union of Mineworkers to accept the awards of the National Reference Tribunal, is being sought by the Derbyshire branch of the union. Referring to the tribunal's recent 5s. a week award, Mr. Bert Wynn, secretary of the Derbyshire branch, said: "Our application has not been taken seriously; it has been avoided. We were unable to take strike action over it, and it is now time to amend the agreement."

MINERS at Argyll Colliery (Argyll), which was flooded after a fire a fortnight ago, are to be employed in developing a new seam while the affected section of the pit remains closed. The new seam contains enough coal to keep the mine in production for 50 years.

WHILE CLEANING OUT a shaft at Ogilvie Colliery (Mon) three miners were knocked over by a flood of water which burst from the wall. After the flood had subsided the men were taken to hospital, where two were released after treatment and one was detained with minor head injuries.

STOPPAGE of work, resulting in the loss of 300 tons of coal, occurred at Pirnhall Colliery (Stirlingshire) last week because a pit deputy described two coal cutters, one of them his son, as "amateurs." The men took exception to the remark and 85 men on three shifts came out on strike.

THE EXECUTIVE of the National Union of Mineworkers is to be asked to inquire into the dismissal of Mr. Alex Morrison (29), an underground worker at Argyll Colliery, who was dismissed by the manager of the pit last month after refusing to work in a section which he claimed was unsafe.

NEW KILN at the National Coal Board's Hednesford brickworks, near Cannock, was fired for the first time on Thursday of last week. It will increase production by 120,000 bricks a week. The works annual output will rise to 32,000,000 bricks a year and that of the Division Five works to 75,000,000 a year. The kiln was built in 16 weeks.

TELEVISION INTERFERENCE from a giant excavator working the open-cast coal site near Abertillery (Mon) is the subject of a report to the Minister of Power being compiled by the Town Council. Previous complaints to the NCB and the Ministry resulted in the machine being screened behind earth banks, but it has since changed its position.

ORDER for the central Leeds smoke control area—believed to be the biggest smokeless zone so far proposed—has been confirmed by the Ministry of Housing and Local Government. The order will take effect from July, 1963, before which time more than 3,000 houses in the area will require fireplace adaptation. A large part of the business and commercial centre of the city is also in the zone.

THOUGH difficulties which had arisen over the transfer of men to the new colliery at Cynheidre, near Llanelly (Carm), have now been resolved, the commissioning of the new mine by Sir James Bowman, chairman of the NCB, which had been arranged for September 8, has had to be deferred. A new commissioning date will be announced when the transfer of men is complete, states the Coal Board.

MORE THAN 1,700 Scottish miners from three pits came out on strike on Friday last over wage claims. At Whitbrigg Colliery (Lanarkshire), 891 men were involved in a dispute among brushers resulting in a loss of 1,150 tons of coal. Steel drawers began a stoppage at Kingshill No. 3 Colliery (Lanarkshire), bringing out 572 men and losing 950 tons of coal. At Benhar Colliery, 259 men were idle, causing a loss of 420 tons, over a grievance among coal-face workers. At Benhar Colliery the men returned to work on Monday of this week.

Two 180 MVA auto-transformers, worth £280,000, have been ordered from the General Electric Company, Limited, by the Central Electricity Generating Board. The transformers are of conventional design and will be installed in the new sub-station at Bustleholm.

African Notes

STEEL PRICES CRITICIZED

Supplies from Europe for Refinery Construction

SOUTH AFRICAN manufactured steel prices were so high and delays so long that most steel supplies were being obtained from Europe, stated Mr. Walter M. Schweitzer, American construction manager of the company building the new £5,000,000 oil refinery at Lourenço Marques. "In Europe you have a competitive market which tries to please the customer. Here you obviously have a monopoly," he added.

A virtually new steelworks has been built over the old works of the Dunswart Iron & Steel Works at Benoni, Transvaal, without loss of production, and the £2,000,000 expansion scheme of the company, started in 1954, is also complete. The company is one of the largest private concerns in South Africa for the production of merchant sections and steel castings. In recent years export markets in East Africa, the Rhodesias, New Zealand and Pakistan have been established.

The Rhodesian Iron & Steel Company, Limited, is building its third blast furnace at its Redcliff works in Southern Rhodesia. The No. 3 blast furnace, as well as the gas cleaning plant, are being supplied to the general design of Head Wrightson Iron and Steelworks Engineering, Limited, in collaboration with RISCOM's consulting engineers, John Miles & Partners (Pvt), Limited, of Bulawayo. The furnace is 17 ft. in diameter.

New RISCOM Products

During 1959, RISCOM introduced a number of new products, including fencing standards and droppers, window sections and 20 lb. rails, and it is hoped to introduce 30 lb. rails later this year. Also this year it is expected that the new blooming mill and soaking pits, No. 3 blast furnace, sinter plant and ancillary equipment and new turbo-blowers and turbo-alternator will be brought into operation. The new sheet mill should be ready for use early in 1961, to produce light plate and black and galvanized sheets.

To further the development of Southern Rhodesia's growing steel centre, Que Que, a joint group comprised of the Que Que Council, local members of Parliament and representatives of mining and industry has been formed. It intends pressing the Government for the establishment of Que Que as the mining headquarters of Southern Rhodesia, the setting up of Government metallurgical laboratories, and the building of a technical school at Redcliff, where the RISCOM works are situated, to serve the Midlands area of Rhodesia.

Delivering the first John Orr Memorial Lecture at the University of Witwatersrand, the general manager of ISCOR, Dr. C. M. Kruger, said he was looking forward to a decision, as a matter of national policy, to prohibit the export of raw materials if they could be processed to better economical advantage in the country. He wondered whether the day had not already arrived when official steps should be taken to prevent the large-scale exporting at cheap prices of valuable minerals. These could easily and economically be turned locally into much higher valued products, before being used in the country or exported.

Dr. Kruger said that a case in point was that of manganese ore and ferro-manganese. The ex-mine selling price of manganese ore was not more than about £5 a ton. In contrast to this, however, the selling price of ferro-manganese was between £42 and £45 a Reef ton. In addition to its piratical effect on the country's economy, the exporting of unworked minerals had an important influence on the earning power of the railways.

The wolfram industry in Uganda is being revived and an American engineer, Mr. C. H. Hall, general manager of a tungsten corporation in California, has been in the country to recommend methods which will increase efficiency in the industry and cut costs. The five or six mines on which he is giving advice either closed down or cut back production drastically in 1958. Only £13,760 of ore was mined in that year, compared with £141,195 the previous year. Wolfram prices have now climbed back from the 1958 low of £210 per ton to a more economical £550, and the mines are gradually returning to normal.

In Swaziland, the proposed railway from Goba to Bomvu Ridge is still under consideration. The report of the mission headed by Prof. Chandler Morse, a nominee of Mr. Eugen Black, of the World Bank, says that construction of a railway is essential only for the large-scale transportation of minerals, and that a road programme of nearly the recommended size will be needed whether or not a railway is built. The ore at Bomvu Ridge is of high quality and the mission considered that the possibilities of steel manufacture should be examined.

Within the next few months wire nails will be produced in Sierra Leone. A factory has now been completed at Kissy, near Freetown, and the machinery has been installed. So far the company has spent about £30,000 in the construction of the factory, buying machinery and importing wire from Belgium for making the nails.

An emergency shaft 9 ft. in diameter is being sunk in the northern section of Clydesdale Colliery, where 437 miners were killed on January 21. The sinking of the shaft is a condition of the agreement under which the northern section of the mine was allowed to re-open in March. It will be completed in a few months, and will be used as a travelling shaft for men and material.

It is additional to the rescue shaft which was sunk after the mishap in an attempt to reach the trapped miners, and will facilitate an increase in the output of the northern section of the mine.

Personal

Dr. R. H. GRIFFITH, director of research at the Gas Council's London research station, has retired. He joined the research laboratory of the Gas Light & Coke Company, Limited, in 1925 and during the ensuing 35 years built up a reputation in the field of catalysis In 1945 he was appointed senior research chemist to the Gas Light & Coke Company, a position he continued to hold with the North Thames Gas Board after nationalization. Dr. Griffith was appointed controller of research of the board and director of the London research station of the Gas Council in 1952. He is a Fellow of the Chemical Society and of the Institute of Fuel, a member of the Faraday Society, and has been a member of council of the Institution of Gas Engineers by whom he was awarded the H. E. Jones medal on two occasions.

After 30 years with the British Aluminium Company, Limited, Mr. JAMES H. DICKIN, manager of the Latchford, Warrington, works for the past 18 years, has retired.

North-western area of the Transport Users' Committee has appointed Mr. B. E. WALLEY, transport officer of the North-Western Divisional Coal Board, a member.

Training officer at Bolden Colliery (Co. Durham) for the past 15 years, Mr. WILLIAM WILSON has retired. He began his career at the colliery as a trapper boy, later becoming a deputy.

Miss ELAINE BURTON, formerly Labour MP for Coventry South, and Mr. W. HEBDEN, of Shoreditch Borough Council, have been appointed members of the Domestic Coal Consumers' Council.

Mr. BASIL BURGESS, an employee of Colt Ventilation, Limited, Surbiton (Surrey), has been appointed by the International Hockey Federation to the panel of International Umpires, Class 1, officiating at the Olympic Games in Rome.

Law Cases

CASHIER ON THEFT CHARGE

AT Chesterfield County Magistrates' Court, John Percival Hyams (28), cashier, was charged with stealing sums of £1 1s., £1 2s. and £1 1s. belonging to his employers, Coalite & Chemical Products, Limited, Bolsover, and with three offences of forgery. He was committed for trial at the next Derbyshire Quarter Sessions, being allowed bail.

It was alleged that after a number of Italian employees did not return from visiting Italy, they were dismissed and Hyams "helped himself" to certain income tax rebates due to them. One of the employees inquired about a rebate due to him, and investigations were started.

Recent Wills

FOSTER, E. A., assistant manager of Stewart & Craig, Limited, engineers, boilermakers, and ship-repairers, etc., of Hull £3,666

REES, CAPT. W. H., first manager of Cefn Road Colliery, Crynant (Glam), later agent for the Vale of Neath group of Amalgamated Anthracite Company, Limited, and a member of the council of the South Wales branch of the National Association of Colliery Managers £4,650

INTESTATE

MACHEN, J. R. A., president of the Yorkshire Area of the National Union of Mineworkers £5,720

LYTHGOE, former traffic manager with John Lysaght's Scunthorpe Works, Limited, pig-iron and steel makers £3,385

Seaborne Coal Supplies Cut By Strike

SEABORNE coal supplies to London and the south have been cut by the unofficial strike of seamen. The Central Electricity Generating Board said on Wednesday that only about one third of the normal supplies of coal for London power stations was getting through. A large proportion of the board's coal is seaborne, but, it said, the situation was one for concern rather than alarm. An official said that there were stocks in reserve, so that they would not be worried about supplies for some weeks.

A spokesman for the North Thames Gas Board said that the board had always adopted the policy of maintaining good coal stocks to meet all obligations. Most of the board's coal is carried by its own vessels, and some of these are affected by the strike.

Regarding domestic consumption of coal, the Coal Merchants' Federation of Great Britain said that last winter seaborne coal amounted to 178,000 tons out of 2,900,000 tons used in London and the south. If the strike continued it might affect supplies in particular localities, but it was not regarded as a significant threat yet.

Manpower Shortage Eases

FIGURES issued by the Ministry of Labour last Friday indicate that the manpower shortage has eased a little. The figures show that there were 355,645 unfilled jobs in civil employment on August 10—24,130 fewer than in July, when the figure was the highest for four years. The fall is greater than the seasonal one of about 14,000 which normally occurs between July and August.

At the same time the number of unemployed has risen by 29,337 to 321,288. On August 15 the percentage of the working population without jobs was 1.4 compared with 1.3 in July. This change, however, was largely caused by the summer influx of school-leavers into the labour market, and by an increase of unemployment among youths and girls. Among adults, unemployment decreased by 180. Areas where unfilled vacancies decreased most were London and the South East, the East and South, the North West and the Midlands.

NUM Branch Official Suspended

COAL face worker at Brodsworth Main Colliery (Yorks), Mr. Arthur Owen (38), has been suspended from the committee of the colliery branch of the National Union of Mineworkers and from holding any official position until May, 1963. This was announced by the Yorkshire Area council of the union on Monday.

The decision followed a report of a sub-committee on charges made by Mr. Owen, that an underground cable to a coal-cutting machine at the pit was dangerous. He said that sparks had been coming from it. The sub-committee reported that it believed Mr. Owen's statement about the sparks to be completely untrue.

Internal Defects in Steel Castings

Their Origin and Ways to Avoid Them

In a paper contributed to the recent symposium on "Internal Steel Quality and Methods of its Assessment" organized by the West of Scotland Iron and Steel Institute, J. Cameron, B.Sc., Ph.D., and J. Courtney, both of whom are associated with the Clyde Alloy Steel Company, Limited, reviewed steel-casting practice, noting the defects which may arise and the ways of avoiding them. They discussed causes of the main classes of defect, mechanism of solidification, gas inclusions, and variations in deoxidation practice. Detection of defects was also briefly treated, but is excluded from this summary of the paper.

PRODUCTION of a sound steel casting involves the pouring of good quality liquid steel at the correct temperature into moulds properly made from suitable refractory material and with the running system so designed and proportioned that the molten metal fills the mould cavity with the minimum of turbulence and mould erosion. In addition, the disposition and dimensions of the feeder heads must be such that all shrinkage occurs in them and not in the casting. In many instances these individual requirements are mutually incompatible. Thus bottom gating, which minimizes mould erosion, produces temperature gradients that are the opposite of those required for optimum feeding. In many ways, therefore, the production of castings has to be a compromise between conflicting technical requirements. Economic factors must also be considered.

In view of the technical difficulties involved, it is apparent that even with stringent control, castings may contain internal defects. It is the purpose of this paper to discuss how and why these defects arise, and the practical steps that can be taken to minimize or eliminate them.

Defects Due to the Mechanism of Solidification

As steel solidifies as a solid solution, it does so over a range of temperature. Also, like most metals, there is a contraction in volume on changing from liquid to solid. Solidification at any point in a casting is initiated when the metal at that position reaches the liquidus temperature; but solidification is not completed at that point until the solidus temperature is reached. Solidification can be represented as an advancing front of dendrite tips growing towards the thermal centre, followed, after a time lag, by an advancing wave of completely solidified metal. The time between start and end of freezing can be considerable so that it is possible for solidification to have started at the centre of a section and to be completed only for a thin zone near the mould/metal interface. Thus, in the later stages of solidification of a section, liquid metal may be present in the central core and also in the interdendritic spaces. As the interdendritic liquid solidifies, there is a contraction in volume and the supply of liquid must be replenished from the central pool of liquid metal, which, in turn, draws metal from the externally provided reservoir or feeder-heads.

With continuing solidification, the interdendritic passages become more and more restricted so that feeding becomes progressively more difficult. Even with a plentiful supply of feed metal its ferrostatic pressure may be insufficient to force liquid into the smaller interstices of the dendrites. This gives rise to the formation of very small dispersed cavities known as microporosity. When the flow of feed metal from the riser is cut off before freezing of the section is complete, sufficient liquid metal may be present in the core to fill up the main interdendritic channels but this will be done at the expense of the central pool of metal. In these conditions, small dendritic-type cavities may be formed, known as centre-line or filamentary shrinkage. With very poor feeding conditions a gross void or shrinkage cavity may be formed.

It will be seen, therefore, that to produce castings free from shrinkage, it is necessary to control the rates of solidification at various positions along the section so that a tapered feed channel is produced, with its wider end towards the feeder-head. This controlled directional solidification is achieved by ensuring that pronounced thermal gradients exist from the furthest point of the casting to the feeder-head. In parts of uniform cross-section fed with a riser at one end, rapid solidification occurs at the other end where heat transfer is promoted by the extra cooling face, the so-called end effect. Solidification is delayed at the riser end because of the heat reservoir provided by the head. In short lengths, a steep thermal gradient conducive to good feeding is thereby produced. As the section length is increased, a zone develops which is outside the influence of the end and riser effects and in which, therefore, there is practically no thermal gradient. The feed channel in this zone, instead of being tapered, has parallel sides, so that over a considerable length the metal reaches the final stages of solidification at the same time. This means that feeding can take place only through long restricted channels. These often become

blocked and the resultant lack of feed metal gives rise to centre-line shrinkage.

Experimental work done on simple shapes by Pellini has shown that for plate-like sections a thermal gradient of 1 deg. to 2 deg. F. per in. is required to produce freedom from centre line shrinkage. Bar-shaped castings require much steeper thermal gradients, namely, 6 deg. to 12 deg. F. per in. to eliminate this defect. The prevention of gross shrinkage cavities, where the lack of feeding is due to riser deficiency, is usually achieved by increasing the solidification time of the riser. The most obvious way to do this is by increasing the riser diameter, but sometimes there are practical difficulties in doing so. Alternative methods of delaying the freezing of risers are (1) later additions of hot metal, (2) exothermic additions to the top of the riser, (3) the use of exothermic sleeves, and (4) electric arc hot-topping.

The first method is self-explanatory and the important factor is the correct time of the hot-metal additions. The top additions in the second method vary from the mildly exothermic materials such as blacking and chopped straw to the strongly exothermic "Thermit" type of compound. These materials usually have a high ash content and after combustion they form an insulating layer. The exothermic sleeves are moulded from a mixture of sand, iron oxide, and finely divided aluminium together with a bonding agent. In the fourth method, the freezing of the head is delayed by the heat provided by an electric arc struck between the liquid metal in the head and a graphite electrode. This method is usually applicable only to large castings fed with a single head.

Micro-porosity which occurs as small dispersed cavities is difficult to detect. Possibly it is produced by the combined effects of shrinkage and dissolved gases, but its mechanism of formation is not fully understood. Important factors in its control are to ensure the best possible feeding and metal of low gas content. Even with these precautions, all heavy sections contain this defect to some degree, but with slight microporosity the impairment of mechanical properties is negligible.

Defects Due to Gas

The delivery to the mould of metal with the minimum gas content is essential for the production of sound castings. Although it may be produced with a low gas content, metal is poured into sand moulds containing moisture and organic materials that give off gas. Also, the first metal to enter the mould cavity may do so in a turbulent manner. The resultant intimate mixing of gas and metal is conducive to gas pick-up. As solidification occurs, the gas segregates in the liquid phase until the solubility limit is exceeded, with the resultant production of gas bubbles that are enlarged as more gas is evolved from the solidifying metal. This defect varies greatly in its distribution in the casting. Some portions may be completely free while other parts show very severe blowholes. This is in contrast to the effects of a "gassy" steel, where the gas content is high due to bad steelmaking practice. In this case, the blowholes are usually smaller and are more uniformly distributed throughout the casting.

A particular type of defect caused by gas is known as pinhole porosity. It occurs sporadically with steel cast in green-sand moulds. The holes originate below a skin of sound metal and are elongated at right angles to the mould wall. They are similar to rimming holes in rimming steel ingots, but in castings they occur with fully killed steel. It has been found that the addition of a strong deoxidizer such as aluminium usually prevents the formation of pinholes and this has given rise to two main theories to explain their mechanism of formation. The first theory is based on the premise that when steel is poured into a green-sand mould the following reaction occurs:

$$Fe + H_2O \rightarrow FeO + 2H$$

The atomic hydrogen diffuses readily through the skin of solid metal to the solid liquid interface, where it reacts with dissolved FeO to form a bubble of water vapour. This bubble acts as a nucleus into which diffuses the gas segregated in the liquid layer immediately ahead of the solidification front. As the solidification front advances, the bubbles become elongated in the direction of wall growth. The chief objection to the hydrogen theory is that even with a dissolved hydrogen content of 15 parts per million and a steel saturated with oxygen, the pressure would be insufficient to nucleate a bubble of water vapour.

The second theory is based on the suggestion that due to the breakdown of moisture at the metal/mould interface, the oxygen content of the metal is locally increased to such a level that there is insufficient deoxidizer present. The excess oxygen reacts with carbon to produce a bubble of carbon monoxide. In the case of carbon/oxygen reaction it has been calculated that a steel containing 0.30 per cent. carbon and saturated with oxygen generates a carbon monoxide pressure of 32 atms., a value high enough to nucleate a bubble. The theoretical objection to this is that in the presence of strong deoxidizers the oxygen content can never be sufficiently high. However, it is possible that a local concentration of oxygen might be produced by the decomposition of moisture at the mould/metal interface.

Both theories have their strong adherents. However, the truth perhaps is that all the gas-forming reactions must be taken into consideration. Some support is given to this view by the fact that in high-chromium steels nitrogen appears to be as potent a factor in the formation of porosity as is hydrogen.

While full agreement on the mechanisms of formation of pin-hole porosity has not yet been reached, the following practical precautions do seem to minimize the occurrence of this defect:— A good vigorous boil; minimum refining period; thorough and correct deoxidation with aluminium; well dried ladles; moulds of high permeability and with a controlled low-moisture content.

Apart from these well-established methods of producing steel of low gas content, some mention

may be made of two newer techniques devised to reduce the hydrogen content of metal. The first method consists of treating the steel by plunging moulded blocks of tetrafluorethylene (Fluon) into the liquid metal. This compound dissociates to liberate fluorine gas which removes the hydrogen partly by chemical combination and partly by a physical flushing action. While this treatment is claimed to reduce hydrogen content by 50 per cent. practical trials indicate that such efficiency of hydrogen removal is obtained only in those instances where the steel has a high initial hydrogen content. With steels of normal hydrogen content the effectiveness of the method is very much reduced.

The second method utilizes refractory sleeves containing a carbonate. These sleeves are fitted round the ladle stopper-rod. The carbonate decomposes on contact with the liquid steel to produce a violent and prolonged "boil" which physically flushes out any hydrogen. On limited trials, this method showed promise of being a practical and effective method of reducing the hydrogen content.

Defects Due to Deoxidation Practice

Aluminium is widely used in the steel-casting industry as a final deoxidizer, as it is the most effective agent for the prevention of pinhole porosity. However, in certain circumstances its use can have adverse effects on the quality of castings. As these adverse effects manifest themselves as an impairment of the physical properties rather than in the form of any physical discontinuity or void, it is not possible to detect them by any non-destructive method. Unlike the void type of defect, these undesirable features once formed cannot be removed or rectified, consequently it is essential to take all possible precautions against their formation.

The impaired metal quality can arise from two separate and distinct phenomena:—(1) Grain boundary sulphides; (2) inter-granular fracture or, as it is sometimes called, "rock candy" fracture.

Grain Boundary Sulphides. —In most cast steels, the indigenous inclusions are predominantly sulphides, as the oxygen content is usually less than 0.020 per cent., while the sulphur content averages 0.030 per cent., and may be as high as 0.050 per cent. in acid steel. When a melt of steel is deoxidized with aluminium, the quantity of deoxidizer used has a considerable effect on the form, size, and distribution of the sulphide inclusions, and that, in turn, may have a pronounced effect on mechanical properties. Dependent on the final deoxidation practice, sulphide inclusions in cast steels can occur in three distinct forms which have been classified as shown below.

The first, known as Type I, are usually globular in appearance and randomly distributed. They are characteristic of steel deoxidized with aluminium in amounts less than ½ lb./ton. Steels with normal sulphur content present in this form have good mechanical properties. The second, or Type II, sulphides are small and globular, but tend to be dispersed in a chain-like arrangement around the as-cast grain boundaries. In extreme cases, where the sulphur content is high, they may form continuous films. Type II sulphides are the characteristic form in steels treated with ½ to 2 lb. of aluminium per ton, an amount which is just sufficient to ensure complete deoxidation, but is insufficient to leave any residual aluminium in the steel. When the sulphides occur in this form, the ductility and impact resistance are reduced and the tendency for the formation of hot tears and cracks is increased. These detrimental effects become less apparent as the sulphur content of the steel is progressively reduced. Type III sulphides are irregularly shaped, randomly distributed, and tend to be larger than Type II inclusions. They are characteristic of steel deoxidized with more than 2 lb. of aluminium per ton. While the mechanical properties are not as good as those obtained with Type I, the impairment is only slight.

One explanation of the effect of aluminium deoxidation on the dispersion of sulphide inclusions is based on the premise that dissolved oxygen reduces the solubility of sulphides in steel. Thus, a steel deoxidized with small additions of aluminium will have a high dissolved oxygen content and the sulphides will precipitate early during solidification. With intermediate amounts of aluminum, the oxygen content will be low and the sulphides will precipitate at the last positions to solidify, that is, the grain boundaries. With excess aluminium present, complex (Fe-Mn-Al) sulphides of low solubility are formed and these also precipitate early.

From the foregoing discussion, it can be seen that to avoid the formation of detrimental Type II sulphides, aluminium additions must be either less than ½ lb./ton or more than 2 lb./ton. In most instances the larger quantity is used. It has been established, however, that aluminium is objectionable in steels for high-temperature service as it promotes graphitization and reduces creep resistance. Indeed, some specifications for creep-resisting steel castings stipulate a maximum aluminium addition of ½ lb./ton. With this smaller amount of deoxidizer the danger of pin-hole porosity becomes more acute and the production of castings free from this defect requires careful control over metal and mould quality.

While this problem has been discussed in terms of the amount of aluminium added to the steel, it is obvious that the important factor is the amount of residual aluminium retained in the steel. It is therefore important that the aluminium additions should be made with the utmost care to ensure maximum efficiency; and that aluminium determinations should be regularly carried out to ascertain what recovery is being obtained. Where teeming times are prolonged, checks should be taken at intervals to ascertain if any "fading" is taking place.

Intergranular of "Rock Candy" Fracture.—This

defect, as its name applies, is revealed when the steel is fractured and manifests itself as a very coarse matt grey fracture with large facets. While not affecting the strength properties, it produces low elongation values in the tensile test, together with very poor impact properties. In addition, in extreme instances it may cause severe cracking of castings as they cool in the moulds. It is confined to steels deoxidized with aluminium and is accentuated by slow cooling from the casting temperature such as occurs with a heavy section.

Investigations have shown that one of the causes of inter-granular fracture is the precipitation of aluminium nitride at the austenite grain boundaries. As this precipitate is seldom visible under the microscope, this conclusion was deduced from the fact that susceptibility to inter-granular fracture increased with increasing aluminium and nitrogen contents, and that inter-granular fracture can be eliminated by air cooling from 1,250 deg. C. At this temperature aluminium nitride is soluble in steel and a relatively fast rate of cooling prevents reprecipitation at the grain boundary. Additions of zirconium and titanium, which have a greater affinity for nitrogen than aluminium, also prevent the inter-granular fracture.

As inter-granular fracture is a function of nitrogen and aluminium contents, the methods for its control are the production of steel with a low nitrogen content, and the addition of elements such as titanium or zirconium to fix the nitrogen as harmless discrete particles of titanium or zirconium nitride.

In addition to controlling the oxygen content of the steel, the ideal deoxidizer for steelfoundry use must fulfil the following requirements:—Prevent pinhole porosity; avoid formation of Type II sulphides, and prevent the occurrence of inter-granular fracture.

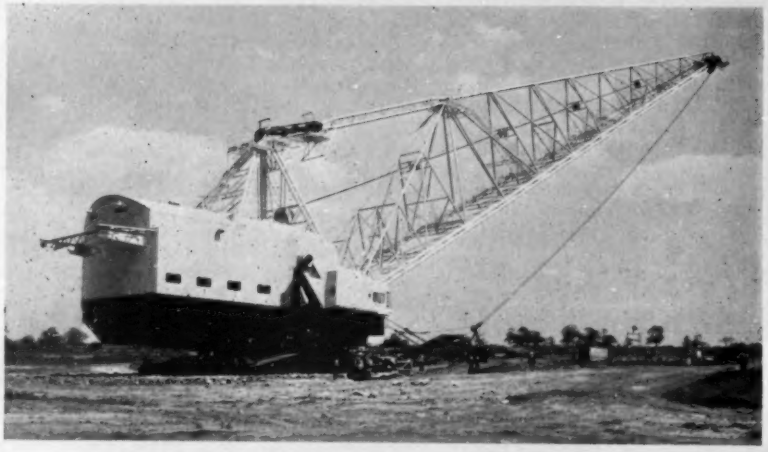
Considerable research work has been done in the United States on the development of a complex deoxidizer to meet these requirements. This special deoxidizer uses aluminium as its major constituent with Mischmetall (cerium + lanthanum) to cause reversion to Type I sulphides, and zirconium to fix the nitrogen. Ferro-silicon is used as a diluent and carrier. This deoxidizer is still in the process of field trials.

Walking Dragline is

HIGHER THAN NELSON'S COLUMN

A 1,750-ton dragline "walking" over 2 yd. a minute on its two 57-ton feet, which are 48 ft. long and 9 ft. broad, has just been installed by Stewarts and Lloyds Minerals, Limited, at its Cowthick ironstone quarry near Corby. Its purpose is to remove the overburden and expose the ironstone.

The 303-ft. long jib, designed and built by Tubewrights, Limited, in co-operation with Ransomes & Rapier, Limited, is constructed of tubular steel and welded throughout for lightness and strength and in its working position the jib head is 185 ft. above the ground—15 ft. higher than Nelson's Column. It has a dumping radius of 280 ft., the 22-cu. yd. bucket digging approximately 33 tons a fill.



GENERAL VIEW OF THE DRAGLINE AT THE COWTHICK IRONSTONE QUARRY NEAR CORBY.

The Cowthick W 1400 dragline's feet move 6 ft. 6 in. every 50 sec., while the cycle of filling the bucket, swinging to the discharging point and returning to the digging position is 56 sec.

Manufacture of the £750,000 machine began at Ransomes & Rapier early in 1957. The new dragline has a slightly larger boom than the company's other walking dragline in the Corby area; this, also of all-British construction, was brought into operation during 1951 and was then considered to be the largest in the world.

MANPOWER—

the Vital Factor in Mining

By J. CRAWFORD, C.B.E.*

(Industrial Relations Member, National Coal Board)

The author concludes: "The basic situation remains that we need and shall continue to need to maintain a very large (and increasingly skilled) labour force. . . . Our basic job therefore remains to hold men against competition, rather than to shed them gracefully or gratefully. In this situation management cannot afford 'get tough' attitudes, even if anyone is inclined to them."

THE coal industry's production programme—what we now term the "National Plan"—is a synthesis of the four great "M" factors. These are:—

Markets: (how much and what types of coal can be sold?);

Mining: (what are the best techniques for getting at the existing reserves?);

Money: (how much have we to spend on getting the coal in relation to our earnings from selling it?);

Manpower: (how many men shall we need and how many will be available to carry through the output programme?).

This paper discusses the fourth of these "Ms"—manpower. The purpose is first to trace briefly the varying importance that this factor has had over the years, in relation to the other three "Ms", and then to raise for consideration the main problems on the manpower side which confront the industry at the present time and seem likely to arise in the future.

The Past

Between the wars labour was a relatively "cheap and easy" commodity, and in the mining industry particularly it was treated as such. The number of men employed in the industry was, in fact, a fairly reliable index of the general state of the country's economy. Increased economic activity meant more men signed on and reduced activity meant more men laid off. Coal mining, like shipbuilding, was notoriously sensitive to the trade cycle, and the changes in mining manpower were consequently violent. Thus, in 1924, at the height of the first post-war boom, the industry's manpower reached its highest point ever—nearly 1,200,000 men employed. By 1933, when the slump was at its deepest, the number of mineworkers employed had been cut to a little over 750,000—a drop of half a million men in less than 10 years. And, as we all remember, a great part of the mining labour force had spent a good part of those years "on the dole." As the country moved out of the depression (through rearmament and so on) the economy stabilized, and, the coal trade picking up to some extent, the labour force remained fairly steady at the 750,000 mark, though large numbers still remained out of work.

In the pre-war economic and political situation the industry's manpower pattern was not surprising: men were taken on from the large unemployed pool when coal was saleable and were sacked or put on short time when demand for coal fell. The economy as a whole suffered from recurring crises of under-consumption. As a consequence, the labour supply was normally in surplus and the numbers employed could be "adjusted" more or less by turning the tap at will. The long-term consequences were bound to be most harmful for the industry—both in terms of human relations within the industry and in terms of efficiency—but who was in a position to care?

The second war changed all that. Within a very short time labour became this country's most vital commodity, and it became a national necessity to protect the level of manpower in the mining industry, on which the whole war effort was necessarily based, against the competition from other industries and from the armed services. Between 1939 and 1941, many miners seized the chance to get out of their long-depressed occupation, and the numbers dropped so alarmingly that the Government had to take measures to keep men in the industry and attract or direct men into it. This was the period of the Essential Works Order and the Bevin boys scheme. By these means (plus substantial increases in wages) it was possible to hold manpower fairly stable at the 700,000 mark for the

* In a paper presented to the annual conference of the National Association of Colliery Managers, Southport, June 1-3, 1960.

remainder of the war period—but only through strenuous and continuous efforts. Manpower had become, beyond doubt, the most important of the four "Ms."

The First 10 Years

Throughout the first 10 years of nationalization the position remained much the same, in that there continued to be both a full employment economy and a shortage of home-produced fuel. The presumption of Government and economic planners was, moreover, that the demand for coal would increase progressively for many years to come. Consequently, the first task of the nationalized industry was to boost output—and to get the men to do it—without regard to short-term fluctuation in the economy. The main difference, from the manpower point of view, was that we now had to get the men without benefit of Government direction of labour or Bevin boys schemes, and so had to depend on improved wages and conditions of work to ensure adequate recruitment.

As a result of the drive for ever-increasing coal production, those years saw a reversal of the pre-war relation between coal-mining manpower and the trade cycle. Manpower now tended to go up as economic activity slackened and manpower became more freely available. We lost in strength when activity in other industries picked up, because in the full employment situation we remained, despite our efforts and success in improving the industry as a place to work in, something of a "residual employer." Looking at the figures, it is seen that coal-mining manpower picked up from 692,000 on nationalization to 726,000 by the end of 1948, as the industry got its share of returning servicemen, etc. During the 1949-51 "boom" (Korean War, stockpiling, and rearmament) we lost men in spite of our efforts and dropped back below 690,000. The 1952 recession gave us a windfall and we went up to 720,000 again, only to lose these men during the boom years 1953-56, when we reverted to just over 700,000.

Manpower Stability

These fluctuations were, however, pretty marginal compared with the big pre-war swings. On the whole, this was a period of overall manpower stability (around the 700,000 mark) based on progressively increasing output accompanied by a gradual improvement in productivity. (Output was increased from 187,000,000 tons in 1947 to over 210,000,000 tons from deep mines by 1955, and the industry's plans provided for a progressive expansion of output to 230,000,000 tons by 1965-70). To keep manpower stable we normally succeeded in recruiting some 60,000 a year to match a wastage of the same order. The variations from this pattern (wastage up to 76,000 in the 1950 boom year: recruitment up to 77,000 in the 1952 recession year) were just short-term fluctuations in this generally stable context. In most places the industry's manpower task was consistently to gain sufficient recruits to hold existing manpower, or increase it, in face of competition from other employers. So far as could be foreseen, this was likely to remain the position for a number of years. Although the published long-term plans for the industry ("Plan for Coal," 1950, and "Investing in Coal," 1956) envisaged some reduction in manpower by 1965, this was likely to be a limited and gradual process, retarded in part by the slow rate of improvement in productivity which could be achieved. Manpower seemed likely to stay at the 700,000 level for some time to come.

Changes in Distribution

Within this overall picture of stability there were, of course, changes in the distribution of manpower—for example, Durham was declining slowly as reserves were exhausted, and manpower dropped from 111,000 at nationalization to 102,000 by 1957. Similarly, South Wales dropped from 115,000 to 105,000 in the period. Meanwhile, the developing coalfields were making efforts to increase manpower—the East Midlands went up from 91,000 to 102,000 in the 10 years. A good deal of redeployment between coalfields was recognized to be necessary, and the board took steps to secure this.

The CIHA programme provided 20,000 houses. Many thousands of men moved within Scotland and from Scotland, Durham, and South Wales to the Midlands and Yorkshire, assisted by the board's transfer and housing schemes.

The Change in 1958

At the end of 1957, after 10 years of expanding output and corresponding recruitment effort on the manpower side, a great and precipitate change occurred in the situation of the industry. Against all the expectations of the economic planners coal demand suffered a sharp contraction, Europe generally as well as Britain. It is not necessary to go into details, because the reasons have been much discussed. Suffice it to say that a combination of industrial recession, competition from oil, and increased efficiency in the use of coal caused a reduction in consumption which was very serious for an "inflexible" industry such as coal. Inland consumption dropped from 218,000,000 tons in 1956 to 213,000,000 tons in 1957, and there was a much bigger drop to 202,000,000 tons in 1958.

After examination of the trends, the board became certain that this trend was not just temporary, but represented in part a permanent change in the future fuel outlook. It was clear that the downward trend could not continue at such a rate for long, but equally clear that coal demand would not come back to the 240,000,000 tons envisaged by "Investing in Coal" in 1956. The industry was faced with a grave problem of immediate surplus production. Steps had to be taken to cut the immediate surplus and to re-tailor the long-term output programme, with corresponding changes on the manpower side.

The methods of reducing immediate production pre-war were simple enough—temporary or permanent closure of collieries and part-time working.

With its responsibility to the nation (to preserve long-term capacity) and to its employees (to avoid unemployment) the board set its face against this course. Its firm aim was to balance output with demand with the minimum immediate damage to the mining community and the minimum-term harm to the nation's resources. Hence the policy of holding large stocks and of cutting open-cast production. But when this had been done there remained a surplus of production. The alternative to large-scale colliery closures was to run down the numbers employed as far as possible by recruitment-control, allowing wastage to reduce the labour force. It was recognized that this could and would create problems for the future in places which needed to expand output later on and would find difficulty in recruiting more men, but this was a gamble the board felt bound to take.

The policy over the two years 1958-59, therefore, was in general one of rapid manpower contraction (without redundancy). A national recruitment ban was imposed in February, 1958, for all but essential juveniles and craftsmen, and this was maintained in most places for the greater part of the following two years, with exemption only on national board authority. As a result, recruitment was cut from 70,000 in 1957 to under 40,000 in 1958 and under 27,000 in 1959. Wastage continued at a high, and recently an increasing, level, and the consequence has been a reduction of 70,000 in the labour force over the two years, *i.e.*, 10 per cent. of the previous labour force. This major contraction has been accomplished with very little industrial friction and a low level of redundancy. There were little more than 2,000 long-term redundancies in 1959, although this was a year which saw the closure of 53 collieries displacing many thousands of men. At the beginning of 1960 only 1.1 per cent. of the mining population was unemployed, about half the rate of male unemployment in all other industries.

During the first four months of 1960 manpower ran down by a further 23,000, by recruitment restriction in some places and, more generally, by the retirement of the over-65s, another measure which has been adopted primarily to reduce the impact of redundancy in the lower age groups. Although a number of collieries and districts or faces within collieries have been closed there has again been very little redundancy.

Conclusions from the Past

This brings us up to the present day, and completes a rough survey of the place that manpower has had in the industry's development over the last 20 to 30 years. From now on it is the intention to deal with the place which manpower is going to have in the future and the nature of the prospective manpower problem. But before turning to this, there are two or three general observations to be made on the experience of the past.

The first point is that both the pre-war situation and the post-nationalization situation up to 1958 tended, in their different ways, to make management unduly prolific in its use of manpower. This may sound paradoxical, since the conditions of the labour market were so different, but there is truth in it. Before the war labour was "cheap and easy," and this was an obvious incentive to indiscriminate and consequently uneconomic use of labour. After the war the status of labour was quite different—we were very anxious to get and to hold men. But this had its own dangers in so far as the industry tended to develop a fixed recruitment habit.

Frequently, it seems, our very awareness of the difficulty in getting men made us regard a high level of recruitment as virtuous in itself—without sufficient regard to the number and type of men we really needed. Thus it was that the numbers of men employed in a pit often remained static even after technical changes had reduced the true requirements for labour, and for this reason, too, we got a poor return for the additional recruits obtained in the recession years 1952 and 1957: the increases in manpower gave us little or no extra coal and productivity suffered. As more recent evidence of this proposition the experience of 1958-59 may be cited, when deliberate reductions in manpower, nationally imposed, produced immediate rapid improvements in productivity, but had comparatively little effect on output.

In the light of this experience, it is suggested that it is only in the last couple of years that circumstances have been such as to make management fully "manpower conscious," regarding men on the one hand as the most valuable of "commodities," but on the other hand seeing recruitment as a means to an end, not an end in itself, and a means which is to be used selectively. This is a valuable lesson for the future.

The Redundancy Bogey

A second observation is that the experience of the past two years has considerably deflated the "redundancy bogey." Before the war a coal-mining redundancy most commonly meant a man unemployed, and for this reason everyone within the industry, both management and union, regarded the prospect of the colliery closures which were forced on us in 1959 with some degree of horror. We had pictures of the depressed and derelict pit villages of the '30s in our minds, and as a consequence we leaned over backwards to avoid closures or redundancies wherever possible. This feeling was very proper and laudible and right. Colliery closures, where there remain workable reserves of coal, should be avoided so far as possible, on both social and long-term economic grounds. But our fears about the employment effects of closures were a good deal exaggerated because they were out of date.

The general economic situation of today, with full employment and high all-round purchasing power, makes the closure of a colliery a good deal more painless, from the human point of view, than in the past. With the exception, always to be borne in mind, of isolated communities entirely dependent on coal mining, the recent experience is that few able-bodied mineworkers remain unem-

ployed for long. Even when a pit closes, the general purchasing power of the community remains high, and the employment opportunities remain correspondingly good. This is the result of the diversification of industry in most areas, the improved travelling facilities, the incidence of female employment, etc.

None of this means that we should regard redundancies with equanimity—they are emphatically to be avoided so far as possible because they are, at the least, a drastic social insult to men and a waste of valuable skills. It will continue to be the board's firm policy to prevent redundancy occurring wherever it can be avoided. But where it does become inevitable it is important that we should take some of the heat out of the subject by appreciating that the social consequences are unlikely in the modern economy to prove as grave as once they did. The coal-mining labour force has been run down by nearly 100,000 in little over two years; yet the overall number of unemployed has steadily fallen in the same period, and unemployment among miners is hardly above 1 per cent.

The present-day economy therefore appears to be capable of absorbing the effects of reducing coal-mining manpower without much strain provided it occurs over time. But it is not infinitely or immediately absorbent. Suppose that the 100,000 men had been laid off overnight, rather than gradually fed into other employment over a period of years. Who could doubt that this would have resulted in great distress and conflict? This leads to a last general observation on recent experience, which is that we have, over the last two years, been responsible for something quite new in industrial history—and something important. For the first time in this country's history, at least, a major industry has taken deliberate and successful measures to protect its employees and the community at large against the effects of a substantial slump in demand for its product. By our policy of stocking we have allowed the manpower adjustments to be made sanely and smoothly and prevented many people from unemployment. When people attack the industry for its stockpiling we should reply proudly that this was the right course for a nationalized and socially-responsible industry to take. They have harmed our own balance-sheet, of course, but it is right for us to consider also the national balance-sheet, where the costs of unemployment and destruction of social capital have to be entered as very costly items.

The Future

Now let us look at the future of coal-mining manpower and the problems which will have to be faced, as the structure of manpower requirements change in line with technical and other developments. It is worth pointing out, first, that the revised plan was itself determined in part by considerations of what could realistically be achieved in the way of manpower adjustments over the next five years or so. This meant on the one hand that we could not set impossible rates of recruitment for the divisions where output is to be expanded. On the other hand, and much more important in the context of a reduced output target, it meant that we could not impose too fast a rate of decline on those older coalfields where output has to come down. It is a basic principle of the approved plan that no coalfield should be asked to contract excessively fast, having regard to the rate of development in "replacement industries" and their capacity to fill coal's place as a principal employer. If it were not for this principle (strictly an ethical one) the Lancashire and Northumberland coalfields, for instance, would be facing much sharper cuts in output than they now do.

Manpower Needs in 1965

The overall position is that the revised plan for coal postulates a manpower requirement by 1965 in the range of 587,000 to 626,000 men, dependent on the possible range in demand from 200,000,000 to 215,000,000 tons. If we think in terms of a demand figure around 200,000,000 tons as the most realistic projection of current trends we must therefore, think in terms of about 590,000 men wanted in 1965. At present [June, 1960] manpower is at the 610,000 mark, but our immediate production plans (based on the need to prevent further stockpiling in 1960) require that we continue reducing manpower this year. It is most likely that we shall end the year with about 590,000 men.

On the face of it this looks satisfactory enough. We shall be ending 1960, nationally, with roughly the number of men we expect to need at minimum in 1965, so that the ideal course would appear to be to hold manpower on a pretty even keel for the intervening period, depending on improved productivity to produce the required progressive build-up in output. Unfortunately, the position is not so simple as that. In the first place, the close national equation between the likely end-1960 manpower and the planned 1965 requirement conceals big divisional variations "above and below the line." In the second place, there is very little prospect that the recent heavy reductions in manpower can be called to a halt at the end of this year. There is every likelihood that manpower will go on falling during 1961 at least, whether we like it or not. In some places we shall "like," but in other places we shall not. We shall be lucky to avoid a further loss of at least 15,000 men during 1961, embracing both the coalfields where we can afford further reductions and those where we should, ideally, be holding or increasing manpower.

Divisional Requirements

Let us look at the pattern of divisional requirements under the plan, in relation to the present position. Six divisions are likely to end this year with manpower at or above their minimum 1965 requirements. They are the Scottish (a surplus of 3,000), Northern (N&C) (2,000), Durham (9,500),

North-Western (3,500), South-Eastern (700), and South-Western divisions.

In these divisions (apart from the South-Western Division, which should end 1960 with its minimum 1965 requirements), there will be scope for further reductions in manpower. But the scope is not great, except in the case of Durham. In all other cases the further reduction which is wanted is a good deal less than the reduction achieved in the single year 1959. The total further reduction planned for these six coalfields over the period 1961-65 is about 19,000, which compares with an actual reduction in their manpower of 29,000 during 1959 alone. There can be no talk of further drastic reductions in coal-mining manpower, under the revised plan, even in the coalfields which will decline in relative importance. In most cases (again excepting Durham) the main part of the necessary manpower reductions under the plan will already have been achieved by the end of this year. From then onwards the pace of reduction will have to be a good deal more moderate, and recruitment will correspondingly have to be a good deal higher, of course. From this point of view the " worst " is already over even for the declining coalfields, and it is important that this should be realized both within the industry and outside.

The fact that the most rapid manpower reductions have already been carried out does not mean that the main manpower problems of these coalfields are finished. Many collieries will necessarily close in them, and a great deal of redeployment between pits and areas will have to be organized if local redundancy is to be avoided. In some of these coalfields (*e.g.*, parts of Scotland, Northumberland, and South Wales), redeployment will be particularly difficult because of geography. In places such as the Forest of Dean, which are small and isolated, it is difficult to see how some further redundancies can be avoided as pits close. In such areas as Central Scotland and North-West Durham the inevitable closures through exhaustion will be so numerous and concentrated that there will be a very big task in transferring these men to work further afield. But by and large it seems most improbable that the contraction in coal mining will throw up any large-scale redundancy problems, provided we organize competently to prevent it by correct phasing of closures and transfers of men between pits. Beyond that it is the task of the Government to ensure that adequate sources of alternative employment are provided in the areas where coal mining will cease to provide the main employment, by measures to attract new industries to them. The Government is fully aware of the industry's plans and the new Local Employment Bill gives promise that the economic needs of these areas will be met.

The Expanding Coalfields

So much for the coalfields which can be said to be " in decline " in a manpower sense. The main part of the decline is already over: the problems over the next few years will be those of achieving a return to something like overall stability, coupled with intensive programmes of internal redeployment. Now let us consider the position in the three main expanding coalfields—the " central group."

The North-Eastern, East Midlands, and West Midlands coalfields are likely to end the year up to 15,000 men below their minimum 1965 requirements, and it is unlikely that they will be able to prevent further losses during 1961, which means that the gap is likely to get wider next year. Even if not, a gap of 15,000 men will be extremely difficult to make up in four years in regions where competition for labour is intense, where in most past years the industry's recruitment has been hardly sufficient to match wastage, and where at present the wastage is far exceeding the recruitment despite our best efforts to stem the flow. On the trends of " the moment," it is indeed difficult to see just how we shall manage, in the West Midlands and south Yorkshire particularly, to arrest the decline in manpower and build it up again to the levels required by 1965. In these places recruitment must be boosted and the rate of labour losses curtailed, if the whole balance of the future output plan is not to be gravely disturbed, because the plan cannot tolerate a shortage of 15,000 men in these vital areas, from which much of the profitable coal is to come.

This forecast of serious manpower difficulties in the central coalfields may seem to contradict what was said earlier about the plan being based on an appraisal of the realistic possibilities for expanding or contracting manpower in each coalfield. It does not. The plan was strictly realistic when produced a year ago, but since then the manpower situation has been changed very rapidly by a great acceleration in the rate of voluntary wastage from the industry, which has meant that manpower has been running down at a considerably greater rate than expected. It has fallen, and is falling, very quickly both in the places where the reductions are desirable and, unfortunately, in the places where we would want to stabilize the position. The number of men voluntarily leaving the industry in the first four months of this year was 6,500 (over 60 per cent.) greater than in 1959. This has affected all divisions, but the rate of loss is, naturally enough, highest in those areas where competition from other industries is most acute. These happen to be the areas where it is intended to expand our output in the future.

The Public Image

The reasons for this disturbing increase in our rate of labour losses are fairly apparent, even if the extent of the increase has been unexpected. The widely publicized problems of the industry in the last two years, the need to close pits, run down manpower, declare some men redundant, and lower our future production sights, have, clearly, damaged the public " image " of the industry which has been built up since nationalization, as a stable and secure place of employment, and created a sense of doubt about the industry's

future both outside it and among the mining communities. As we know, the difficulties of the industry have been vastly exaggerated for all sorts of reasons, but they have had their effect. At the same time as we have been in difficulties (both real and imaginary), the economy has been entering a boom period, and many other industries have been expanding their labour requirements. Hence, an incentive to leave the industry and the opportunity to get other work have been created at the same time. This is a new situation (in the past recessions in coal have normally been accompanied by recessions in outside industry) and the effect of it on our ability to hold labour has inevitably been serious.

The moral of this is obvious. We know that the industry has a great and dependable future, but we have got to convince the public and the mineworkers in general that it is so. We have a great job of corrective propaganda to do if we are to restore confidence in the future both within the industry and among the communities from which we draw our recruits, and every official of the board has a duty to assist in this task by his words and his example. Otherwise we face the prospect of a continued involuntary decline in the number of mineworkers employed to a point well below the minimum of the industry's long-term needs for men, which means, of course, that the industry would be unable to meet the country's continued need for coal. In that situation, either the country's economy would be impeded, or it would look to other sources of fuel to satisfy its growing needs.

Summing Up

What are we to conclude from this about the place and importance of manpower in the industry today and tomorrow? What has been said demonstrates that it is fast becoming, perhaps more than at any time in the past, the key factor in shaping the future production programme. There are coalfields where we can safely accommodate further reductions in the numbers employed, but in most of these cases the margin, now, is not great. The main part of their necessary trimming and slimming has already taken place, and very soon even they will be faced with the task of restoring stability of numbers. The problems of achieving a smooth decline in these places are fast being outweighed by the problems of holding and increasing manpower in the developing central coalfields. Already, large areas of the Midlands and Yorkshire are facing acute recruitment problems, and these difficulties are likely to become serious and general over the next two or three years unless we can stimulate recruitment and curtail the rate of wastage. We shall have no assistance from outside in doing this from now on—no Government direction of labour, no national service exemptions, to help us. We shall be fighting on our own to get and hold the men we need, and for a while, at least, until we have succeeded in rebuilding that essential public confidence in the industry's future, it is going to be a difficult task. Particularly we have to encourage youth to join the industry: it is on them that our future depends.

Of the two factors which determine the availability of labour recruitment into the industry and wastage from it apart from the recruitment of juveniles from school, wastage is the more important. It is good to receive a new entrant, but it is worse to lose a trained miner. The loss of an experienced workman is a blow to operational efficiency and should cause a manager concern, whether his is a developing pit which will be needing that man's skills in the future, or even a pit near to closure, because these skills will normally be wanted at another pit.

This factor should influence all management's thinking and attitudes. Men are the most vital component in production, whether you look at it from a moral standpoint or from a hard-headed business angle, and we cannot afford to misuse them. The disturbances of the past two years, it becomes clear, have been to a large extent temporary and transitional ones. What emerges from them is no more than that the industry as a whole faces a stable productive future rather than an expanding one as had been earlier thought. The basic situation remains that we need and shall continue to need to maintain a very large (and increasingly skilled) labour force in the context of an economy which is generally "manpower hungry." Our basic job therefore remains to hold men against competition, rather than to shed them gracefully or gratefully. In this situation management cannot afford "get tough" attitudes, even if anyone is inclined to them. In every sense it is essential that we conserve our men, encourage their morale, and earn their loyalty, with the assurance that good times are to come.

"Clipstone" Lip Bracket

MR. S. MORRIS, a National Coal Board safety engineer at Clipstone Colliery, near Mansfield, is responsible for a lip bracket designed to fit into the ends of twin girders, which are set at right angles to the coal face at gate ends. The brackets are made so that rippers can easily set them without effort and without moving any of the ripping dirt, after the ripping has been got down. They can be easily set by one man, and the face of the lip can be rapidly made safe and secure.

The number of brackets to be used at any lip is judged by the number of girders set under the lip. If the ends of four girders show across the edge of the lip four brackets can be used to cover the whole of the ripping lip.

Near the top of the vertical arm of the bracket is a small bracket for carrying a long batten, which affords support for the scaffolding and provides a canopy covering, making the setting of the arch girders very easy for the rippers. By leaving the canopy covering in position after the ripping has been done, any dirt that falls off the lip above the lip bracket is prevented from striking persons passing under the lip while travelling on to or off the face.

ADDITION OF SLAG TO CHARGE IMPROVES PRODUCTIVITY

ACID OPEN-HEARTH PRACTICE IN AUSTRALIA

In an article entitled "Improved Acid Open-hearth Practice by Addition of Slag to Charge" in the March issue of the BHP Technical Bulletin, the authors, K. J. Smith and J. C. Richardson, describe how an addition of acid open-hearth slag to the charge accelerates slag formation, reduces wear on banks and bottom, increases metal yield, and gives an overall increase in productivity of about 15 per cent. A short trial with crushed blast-furnace slag indicated that its use would give similar results. The following is a summary of the article.

THE acid open-hearth furnace at the steelfoundry at Newcastle Steel Works has a nominal capacity of 40 tons and is one of the two remaining producer-gas fired open-hearths in Australia, the other being a basic furnace situated in the same shop. The prime function of the acid furnace is the manufacture of iron and steel rolls, the remainder of its capacity being utilized for the production of fully killed steel ingots.

Previous Practice

Prior to the recent change in operation, a typical charge for ingot heats consisted of 35 tons of steel scrap, 5 tons of basic pig-iron, or 5 tons of hot metal and 12 cwt. of coke breeze. The scrap used consisted of selected bloom butts containing under 0.03 per cent. phosphorus and sulphur.

The charge used for steel rolls varied according to the melt carbon required, and foundry irons were used where there were severe limitations on phosphorus and sulphur contents. For iron roll heats, the charge consisted of approximately 50 per cent. iron roll scrap and 50 per cent. pig-iron the latter being of either low- or high-phosphorus type with varying silicon contents. These were blended to give a desired analysis at "melt". In these heats the phosphorus and sulphur specifications preclude the unlimited use of pig-iron or hot metal for carbon additions, and it is usual to charge 5 cwt. of coke breeze and to use another 3 cwt. during melting down to minimize the oxidizing effect of the open-hearth process.

Effect of Coke in Normal Furnace Operation

During the working of the heats almost invariably quantities of unburnt coke rise to the surface, usually completely "blanketing" the bath. Heat transfer from flame to metal is immediately retarded, and heat reflection to the roof is accelerated so that fuel has to be reduced for periods up to 2 hr. until a workable slag is formed. Carbons at "melt" are also unreliable under these conditions.

Experimental Heats with Slag Additions

Every effort made to eliminate these undesirable occurrences, by varying the charging sequence, proved ineffective. Consideration was given to the use of various additions to the slag and, in consequence of a suggestion by a melter, it was decided to recharge acid slag experimentally, to provide the necessary cover and to improve heat transfer.

Since phosphorus and sulphur in acid practice are not held in the slag, such slag could be recharged to subsequent heats to obtain the beneficial effects without detrimental pick-up of these elements. The first heat made containing a slag addition was tapped on July 19, 1958. The charge used on this heat consisted of 36 tons of scrap, 5 tons of basic pig-iron, 9 cwt. of coke breeze, and 16 cwt. of return slag. The "charge-to-tap" time was 8 hr., compared with 10 hr. 32 min. for the previous average heat time.

On subsequent heats the quantities of slag and coke were varied and a charge mixture was adopted which appeared to give the best results for ingot manufacture, namely, 35 tons of steel scrap, 5 tons of basic pig-iron or hot metal, 6 cwt. of coke breeze, and 16 cwt. of return slag.

On iron roll heats, the duration of "charge-to-melt" was unduly long and resulting heats were difficult to work. It was found that when slag was added to the charge, coke could be eliminated and the "charge-to-melt" time was again considerably reduced. Resulting heats were easier to work and far more responsive to the treatment peculiar to this type of metal. With steel roll heats, similar results were also obtained by the reduction of heat times.

Results of Furnace Trials with Slag Additions

Following the success of the preliminary trial (2.4 weeks), slag additions were made for the balance of the furnace campaign (11.7 weeks). Table 1 summarizes the results and compares them with previous practice in a period when a record number of taps per week was being achieved.

The high-silicon ingots (1.7 to 2.0 per cent. Si)

TABLE 1.—*Comparative Heat Statistics.*

Type of product.	Comparison period prior to slag additions.		2.4-week experimental period with slag additions.		Slag-enriched charges 11.7-week period.	
	No. of heats.	Charge to tap.	No. of heats.	Charge to tap.	No. of heats.	Charge to tap.
		Hr. Min.		Hr. Min.		Hr. Min.
1(A)—Ingots with pig-iron charged	10	10 14	4	9 51	34	9 26
(B)—Ingots using hot metal	23	10 04	4	9 35	29	9 03
2(A)—High-silicon ingots with pig-iron charged	28	10 21	3	10 36	18	9 13
(B)—High-silicon ingots using hot metal	32	9 22	6	10 03	34	9 02
3(A)—Steel rolls with pig-iron charged	28	10 43	6	10 52	30	9 32
(B)—Steel rolls using hot metal	21	10 26	5	11 39	15	9 01
4—Iron rolls	29	11 43	6	12 23	34	9 36
Av. heats per week	14.3		14.2		16.4	
Av. " charge to tap "		10 27		10 50		9 16

were segregated from other ingots, because these heats have a standard finishing cycle of 50 min., which is necessary to allow the bath to become homogeneous after the large addition of 75 per cent. ferro-silicon.

Production Rates

The comparative figures in Table 1, show an 11.3 per cent. faster heat time and an overall heat increase of nearly 15 per cent. in favour of the recent campaign of slag-enriched heats. The percentage of heats containing hot metal in the charge was 44.5 for the comparison campaign and 40.2 for the return slag period investigated.

Hearth Maintenance

In acid open-hearth furnaces, generally speaking, " between-heat " times are usually high. For the three campaigns prior to the introduction of slag, the " between-heat " times averaged 1 hr. 16 min., 1 hr. 25 min., and 1 hr. 14 min., respectively, an overall average of 1 hr. 19 min. For the 11.7 weeks with return slag charged, the average between-heat time was 56 min., a reduction of 29.1 per cent. The improvement was due to reduction of the lower bank, bottom and taphole delays, as borne out by Table 2.

TABLE 2.—*Furnace Delays.*

Delays, Mins. per heat.	Previous campaigns.			11.7-week campaign with slag.
	1.	2.	3.	
Fettling	30	32	32	33
Burn out	8	8	7	7
Banks	10	10	12	2
Bottom	10.5	7.5	9	3.5
Taphole	12	8	7.5	3.5
Electrical	0.5	1.5	0.5	0.5
Mechanical	—	—	1.0	1.5
Sundry hot brick repairs, etc.	5.0	18.0	5.0	5.0
Total	1 hr. 25 min.	1 hr. 16 min.	1 hr. 14 min.	56 min.

Increased Metallurgical Yield

During the run of charging return slag, extensive tests were carried out to determine actual metallurgical yields. The results are shown in Table 3.

These higher yields can be attributed to the new practice because the slag when formed is practically satisfied for iron content and metallic loss is thereby reduced.

TABLE 3.—*Yield.*

Heat.	Total wt. of input.	Total wt. of product or gross metallurgical yield.	Per cent. recovery.
	Tons cwt. qtrs.	Tons cwt. qtrs.	
1	43 0 1	41 7 3	96.2
2	43 0 3	40 14 0	94.7
3	43 8 3	41 0 0	94.5
4	41 4 1	39 8 3	95.4
			Av. 95.2

Effect on Quality

The quality of steel ingots, steel rolls and iron rolls has remained the same. In the case of iron rolls this is particularly encouraging, as iron rolls are very sensitive to any variation which could cause an adverse effect on their quality.

TABLE 4.—*Typical Analysis of Slags.*

	Without return slag addition.	With return slag addition.
SiO_2	56.67	51.34
FeO	19.70	20.11
Fe_2O_3	1.93	2.90
P_2O_5	3.74	2.27
Al_2O_3	—	—
MnO	14.9	16.68
CaO	1.48	2.10
MgO	2.45	3.32
Cr_2O_3	—	2.21

Comparison of Slag

As may be seen from Table 4, the SiO_2 content has been lowered, while FeO and MnO have increased accordingly, thus maintaining approximately the same iron, manganese, and silicon total. Physical differences are noticeable; previously the slag was green in colour and had a fluidity of 5 to 7 in. as measured by the Herty viscosimeter. The new slag varies from grey to black and gives an 8 to 10 in. run in the viscosimeter.

Conclusion

The practice of adding tapping slag to an acid open-hearth furnace accelerates slag formation, lessens bank and bottom delays, increases metallic yield, and gives a marked increase in production rate.

ACCIDENTS ON POWER-LOADED FACES

North Western Divisional Inspector's Report

THIRTY-NINE persons lost their lives in and about coal mines in the North Western Division of the Mines Inspectorate during 1959, compared with 30 deaths in the previous year and with an annual average for the three years 1956 to 1958 of 31.7. There were 131 cases of serious injury last year, against 167 in 1958 (Table 1). Comment on the figures is made by Mr. R. H. Clough, HM Divisional Inspector, in his report for 1959 under the Mines and Quarries Act, 1954 (Stationery Office, 3s.).

Output of saleable coal in the division last year totalled 14,024,963 tons, compared with 14,950,300 tons in 1958, while output per manshift at the face rose from 64.6 cwt. to 70.4 cwt. and overall output per manshift went up from 23.2 to 24.7 cwt.

Eleven fatalities occurred due to falls of roof in the face working; 29 persons were seriously injured. Three men were killed by one extensive fall on a longwall face where there had been frequent changes of types and systems of support, accompanied by changes, too, in the method of power loading. Despite these changes, and perhaps because of them, the face advance was slow and roof conditions deteriorated, resulting finally in a large fall which buried the men when they were engaged in moving over the armoured conveyor. The occurrence of an earlier fall on this face, states the inspector, should have prompted a careful resoration of roof control before persisting with power loading. When the fall occurred, the face was supported by a mixture of hydraulic, rigid steel, and wood props—a most unsatisfactory combination.

No Temporary Supports

On another power-loaded prop-free-front face, a collier was killed by a fall while attempting to clean up coal between the conveyor and the face without setting temporary supports required by the conditions under which an exemption from forward supports had been given. There had been severe prop penetration, leading to pronounced roof breaks in the face working. Consequent failure of the waste roof to break down made matters worse by limiting the packing to improvized building, including the use of filled bags. Measures eventually taken to prevent prop penetration alone were successful in transforming the conditions on this face.

In another case, on a machine cut, hand-loaded face, a large fall followed the firing of a coal shot and a collier was killed. In this case the prop density was below that laid down by the Support Rules for which exemptions have been granted. These exemptions were withdrawn forthwith on the grounds that they were not being properly observed. Another fatality occurred on a longwall face when supports were displaced by a roof fall. In this case, there was again a mixture of supports having different resistances and, although convergence was not producing displacement, there were visible roof breaks.

On a flight-loaded face in a seam 6 ft. 6 in. thick and inclined at a gradient of 1 in 3 where coaling was done on the day and afternoon shifts, the dayshift commenced work to complete the cycle left by the previous afternoon shift. Over a length of 45 yd. bars had been extended to the face, but no face side props set, and the deputy stoppd any further flighting, giving instructions for these props to be set. A collier on the face side of the conveyor preparing to set a prop was struck by a fall of coal 21 ft. in length and sustained severe injuries from which he died a few minutes after being released. The inspector emphasizes that it is entirely wrong and very bad practice for flighting to proceed at a faster rate than supports can be set behind the machine.

A collier, cleaning up loose coal in the unsupported face side track of a shearer loader face while the machine was stationary at the stable, was struck by a fall of coal and dirt 20 ft. in length which pinned him face downwards against the cable car; he was dead when released about 15 min. later. No temporary supports had been set on the face side of the conveyor while cleaning up was being done, contrary to one of the con-

TABLE 1.—*Persons Killed or Seriously Injured in Coal Mines in the North Western Division during 1959, Compared with the Average for 1956-58.*

Classification of accident.	Killed.		Seriously injured.	
	1959.	Average, 1956-58.	1959.	Average, 1956-58.
Underground:				
Falls of ground:				
Working face:				
(*a*) Falls of roof ..	11	4.0	29	25.0
(*b*) Falls of face or side..	4	3.7	12	23.3
(*c*) Falls elsewhere ..	3	6.6	19	20.4
Total falls	18	14.3	60	68.7
Haulage and transport.. ..	10	7.7	36	42.7
Miscellaneous causes	8	8.4	24	38.6
Total underground	36	30.4	120	150.0
Total surface	3	1.3	11	16.3
Underground and surface ..	39	31.7	131	166.3

ditions imposed when granting the exemptions necessary to permit this system of working. Temporary props, in the circumstances of this accident, would probably have broken the fall of coal from the face.

There were five cases of fire below ground, none of which caused injury. On a diesel locomotive the accelerator lever failed to return to the "off" position, and this caused excessive heating when the locomotive was stationary with engine running. Coal dust and waste oil caught fire and continued burning until the arrival of an overman who closed the fuel supply valve and extinguished the flames. A new accelerator arrangement was afterwards fitted.

When the drive head of a tandem face scraper chain conveyor was advanced, a patch of hot small coal about 1 ft. dia. and 3 in. deep was found which glowed when disturbed. It was quickly extinguished by the application of foam and stone dust. The waste had fallen right up to the drive head and it is likely that a piece of stone had jammed underneath and been rubbed by the chain or that the chain was running in small coal.

A face conveyor belt was found burning on a Friday evening some 5½ hr. after it had been last used. The cause was definitely established, but the evidence suggested that the conveyor had been running unattended. At the end of the dayshift the attendant had used the remote control device for stopping the conveyor, but had not subsequently opened the gate-end switch.

Smoke in a return airway led to the discovery of an intense fire in a roadway and the area had to be sealed off. Subsequent inquiries suggest that an electric cable in the roadway had become defective causing the protective system to operate, and that power had been repeatedly restored to the

the periodical transfer of all flexible cables from It appears that the electrical staff had failed to examine the cable for some time on account of its inaccessibility.

Much better progress, states the inspector, is now being made towards the fire-resistant treatment of the linings of single intakes, as required by Section 70 of the Mines and Quarries Act, 1954, but from the end of 1959 there remain only two years of the period of grace at the end of which many single intakes must be so protected.

Except for permanent main haulage roads and shaft sidings, the selection of fire resistant lining now tends towards lagging boards used with steel arches. The boards are either pre-treated for fire resistance before being taken underground, or are subsequently sprayed with one of the various types of fire-resistant covering. Boards appear to offer a greater flexibility in maintenance compared with other methods using inherently non-inflammable materials. However, if pre-treated boards are confined to those intake airways where fire resistance is compulsory, careful organization of supply will be necessary to avoid treated and untreated boards becoming mixed, since they are almost indistinguishable in appearance. More assurance would result if treated boards were used exclusively.

There has been some small increase in the number of thermally operated water sprays at conveyor driving heads. While a fire risk may be inherent to such places, they are usually manned when running, but the detection of frictional heating at individual points throughout the whole length of a roadway conveyor, where a fire would be equally dangerous, still depends on frequent and vigilant patrolling. Inspectors still report conveyor belts and rollers encumbered with coal spillage and dust.

Electric Cables in the Lorraine Coalfield

CAREFUL maintenance is required in the use of electric cables underground as they are judged to be items of plant which are most liable to damage. The footage of cables repaired in the Lorraine coalfield has been increasing since the introduction of electricity below ground and in 1956 a central district repair workshop for the repair of cables was created. Thus, four years' experience has been obtained in the repair of cables and in the July issue of Revue de l'Industrie Minérale, journal of the Société de l'Industrie Minérale, M. Coppens reviews this experience in the centralized maintenance of flexible cables in the Lorraine coalfield, where the footage of cables repaired per year rose from 138,566 in 1956 to 459,114 in 1959.

While ensuring a more thorough maintenance, centralization has enabled it to be done at lower cost; the cost per foot has been reduced from 0.51 NF/ft. in 1956 to 0.34 NF/ft. in 1959. Also,

the periodical transfer of all flexible cables from the collieries to the workshop has enabled technological and economic questions to be investigated.

The Valmont workshop comprises space for three to four days' work, a test room for the tracing of all faults and insulation checks, a vulcanizing shop for the cold repair of small cable cuts and hot vulcanizing for large-scale overhauls, and an air-conditioned store. Eleven workmen and one foreman, who also maintain the flame-proof couplers fitted to the cable ends, are employed.

All cables are listed in a file kept at the workshop in which the age is noted together with all the repairs which have been carried out. The cables which are at present in service are up to 10 years old, the oldest being in the semi-flexible cables. The manufacture of cables for use in the Lorraine coalfields has not yet been standardized and the results collected in the file will be of help in establishing standardization.

Internal defects which may arise during the manufacture of steel plates and precautions that may be taken to avoid them are discussed by J. E. Roberts, M.Eng., and I. M. Caskie, B.Sc., A.R.T.C., both of Colvilles, Limited, in an illustrated paper presented to the symposium on "Internal Steel Quality and Methods of its Assessment," held recently by the West of Scotland Iron and Steel Institute. The authors also describe the technique of plate examination and consider the standards of internal quality. Extracts from this contribution are appended.

INTERNAL DEFECTS in STEEL PLATES

Their Occurrence and Methods of Detection

"INTERNAL defects" are defined by the authors as those which cannot be seen on the plate as it leaves the mill rolls before the plate has been cut to size for delivery.

Origin of Internal Defects

Lamination.—This is perhaps the most common cause of complaint and consists of a complete discontinuity in the plane of the plate, covering an appreciable area. The term is rather loosely used and may cover defects near the surface of the plate, at approximately mid-thickness, and either in the middle of the plate or near the edges. Lamination near the surface is nearly always due to what is known as shell, caused by steel spraying or surging on to the walls of the ingot mould during teeming, solidifying there, and acquiring a film of oxide so that when the centre of the mould is filled with steel, the surge or shell of metal round the outside of the mould does not remelt or weld on to the body of the ingot, because of the oxide barrier, and remains as a more or less separated skin throughout further processing and into the finished plate.

Lamination at approximately mid-thickness is normally due to either primary or secondary pipe, both of which are shrinkage cavities, the former at the top of the ingot, particularly in killed steels, and the secondary pipe towards the base of the ingot, where molten steel has been trapped by solidification across the full cross-section of the ingot higher up so that adequate feeding of the bottom of the ingot has been unable to take place. The result is that when the bottom does finally solidify a small shrinkage cavity remains at the centre of the ingot. If sufficient deformation occurs during conversion of the ingot into a plate and no oxygen is able to get to the surfaces of the shrinkage cavities, these will usually weld together during rolling and may eliminate the defect as far as the finished product is concerned. If, on the other hand, the reduction is small, or, alternatively, oxygen or air is admitted to the cavity before it is fully welded up, as may happen if a slab rolled from an ingot is sheared into several pieces and the sheared edge cuts across the incompletely welded cavity, then oxide skins are formed and prevent welding up during further rolling, so that the defect is still present when the plate is finished.

A third form of lamination is that due to what is commonly called "over-roll." This is always at the edges or ends of the plate and is due to the pattern of deformation during rolling, where the surfaces are elongated to a rather greater extent than the mid-thickness of the slab, resulting once more in the trapping of oxide films at approximately mid-thickness of the finished plate. This trouble is more likely to occur where a thin plate is rolled from a thick slab than where the degree of reduction from slab to plate is relatively small and should only appear on the finished plate if the discard allowance from the as-rolled plate to the finished size is too small to remove material so affected.

Inclusions.—Non-metallic inclusions in the form of deoxidation products or sulphides can occur in considerable quantities and produce what is known as a "dirty" steel. The trouble may be confined to small areas or may be general over the whole of a plate. In the case of small regions of excessive inclusions, the trouble may be traced to such things as a lump of slag falling into a mould during teeming, the remains of the bottom of pipe, because impurities tend to congregate in the last metal to solidify, and similar causes. Generally, dirty steel is related to the state of oxidation of the steel and hence the quantity of oxides produced by the various deoxidants that are added, and also by the time available for these oxides to float out of the steel in the ladle and join the slag, rather than being carried into the mould and trapped by the solidifying steel.

A poor teeming stream, where there is much spraying, can give rise to a dirty steel due to the oxidation of the small droplets of the stream. It is particularly difficult to maintain a clean steel when deoxidants such as aluminium are added

directly to the metal in the mould during teeming, as the time available for the oxides to float to the surface is considerably restricted and, in addition, it is possible for the oxide scum floating on the surface to be trapped at the edges of the ingot or carried down by the stream of metal into the body of the ingot and to give rise subsequently to defective regions.

Hairline Cracks.—These are, as the name implies, extremely fine cracks occurring in the body of the plate. Their origin is the rejection of hydrogen from solution, especially during the austenite to ferrite transformation, the hydrogen having insufficient time to diffuse to the outer surfaces and escape during processing from an ingot to a plate. The presence of hydrogen depresses the normal transformation from austenite and hairline cracking is most common in alloy or low-alloy steels, particularly those containing elements, such as molybdenum, which in themselves inhibit the austenite transformation. In addition, the troubles are aggravated by the presence of inclusions which act as centres where the hydrogen can build up considerable pressures. The most likely area for hairline cracks to appear is, therefore, in the areas solidifying last and liable to contain groups of inclusions, that is, the axis of the ingot. These cracks occur some time after rolling is completed and the plate has cooled to room temperature, and are a form of brittle fracture on a micro-scale.

Detection of Defects

There are perhaps four major methods of detecting internal defects in steel plates.

Visual Examination.—All plates are subject to a visual examination, which is mainly concerned with surface defects outside the scope of this paper; and also the examination of plate edges for any evidence of lamination which comes into the category of internal defects being discussed. The effectiveness with which laminations are detected depends to a considerable extent on the smoothness of the cut edge which is being examined. In the case of a sheared edge, only gross laminations are likely to be detected, and even this is dependent on the condition of the shear blades. Towards the end of a run with a given pair of blades, the quality of the cut edge deteriorates, making it even more difficult to detect the presence of laminations. With a gas-cut edge, detection of laminations is very much easier, gross laminations cause difficulty in cutting and become very obvious, and even small laminations produce a slight break that can readily be seen on the cut surface. Even so, the effectiveness of this examination is influenced to a noticeable extent by the quality of lighting available for examination of the edges, defects being more readily discernible in daylight than in artificial light. As a steelworks operates for 24 hr. a day it is unavoidable that some of this edge examination takes place under conditions that are not ideal. Visual examination has the further disadvantage that it gives an indication of the extent of the defects only in one dimension—along the edge examined—and no indication at all of the quality of the plates except round the perimeter.

Magnetic Methods.—Magnetic methods can be used as a supplement to visual inspection in order to detect defects which are on the edge of a plate. It is possible by such means to disclose the presence of inclusions, but the time it takes to carry out such an examination, precludes its use for routine purposes in the steelworks. It is also doubtful whether it would serve any useful purpose except in the few instances where major laminations do not show up even on a gas-cut edge, but would be shown by magnetic examination—as in other instances the inclusions may be very localized and may well be completely removed by the fabricator in preparing the edges of the plate for welding. It is obviously impossible for the steelmaker to know precisely how his customer intends to treat the edges of all plates despatched nor can he know the standard of acceptance suitable for the various welding processes, etc., employed by the different users.

Magnetic detection has, nevertheless, played its part in a few specialized instances, in particular in the detection of hairline cracks. It was, for example, used as a routine method of checking the condition of low-alloy high-tensile weldable steel plates produced by Colvilles in thicknesses up to as much as 7 and 8 in., where some trouble had been experienced due to hairline cracking if the plates were allowed to go cold for a considerable period between rolling and heat treatment. In this instance, samples were cut from the areas coinciding with the axis of the original ingot. The samples were then ground on the full thickness of the plate and magnetically examined. On the occasions when hairline cracks were present, they showed up very clearly, and the plate was withdrawn from production. Although this test was perfectly satisfactory, it took quite a time to prepare the testpieces and in fact by suitable control of the maximum delay between rolling and heat treatment of the plates, the trouble from hairline cracking was eliminated and it has been found possible to dispense with routine testing. In any event, ultrasonic testing is more convenient and has the added advantage that the material tested is that which will be despatched and not an off-cut.

Examination of Mechanical Testpieces.—All boiler plates and a fair proportion of ship plates are tested for tensile strength properties in the test house. In addition, bend tests were carried out on every plate and some qualities are further tested for notch ductility by means such as the Charpy V-notch impact test. Examination of the fractured surfaces of tensile and impact testpieces and of the tension surface of a bend test, can often give an indication of the internal state of the plate in the region from which the testpiece was taken. This is particularly so for lamination and excessive inclusions which show up on the tensile testpiece by what are known as "woody fractures" instead of the smooth cup and cone associated with a clean piece of steel.

Similar information is sometimes provided by the fracture appearance of the impact testpieces. A bend test may disclose the presence of gross lamination by opening up of the layers of the steel along the edges of the bend, but it can also reveal sub-surface defects by breaking up of the surface of the bend specimen. This method of assessment of internal standards has the same disadvantage as visual inspection of edges of the plate, that is, it is restricted to a very limited area of plate and is not necessarily representative of the general plate quality. It is usual, therefore, for testpiece indications to be confirmed by more detailed examinations of the plate itself before final rejection or acceptance.

Ultrasonic Testing

Ultrasonic testing has grown considerably in importance over the last ten years and it is the only convenient method for assessing the internal quality of a plate at positions remote from the edges. In the last three years several important advances have been made, including the application of automatic compensation for fluctuation in the amplitude of the bottom echo caused by variation in the "resistance" offered by the plate to the ultrasonic beam. This fluctuation takes place not only between plates but also within a single plate and cannot be wholly attributed to surface contact. The development of automatic control of the bottom echo has enabled the introduction of an effective automatic flaw-warning device to signal the presence of defects in excess of a present minimum size.

Reference may usefully be made, however, to the developments in the application of ultrasonic testing to the examination of steel plates on a routine basis and the principles underlying the methods adopted. The objectives of routine ultrasonic testing are the detection of major laminar defects and the assessment of the general "internal" quality of the plate with regard to minor laminar defects and inclusions. This means that the whole volume of the plate must be explored and the nature of the defects detected, examined to determine their severity. This led to the introduction of a two-stage testing procedure.

The first stage involves the examination of the plate area along grid lines drawn on the plate surface. The second stage comprises the detailed examination of defects found during stage one. and the determination of their size by one of the following methods: (1) Comparison of the flaw echo and bottom echo amplitudes. This applies where the flaw area is much less than the ultrasonic beam area. (2) Comparison of the relative echoes obtained from the flaw and from a suitable testblock containing either flat-bottomed holes or slots at a similar depth to the flaw in the plate. (3) Measurement of the distance moved on the surface of the plate when a flaw echo appears on the trace. This method applies to large defects where the error introduced by the beam area can be neglected.

The actual procedure adopted in any one instance will be dependent on the equipment available and the requirements of the specification if the testing is being carried out to an agreed standard.

Equipment Characteristics Required by Colvilles.—On the basis of experience of testing several thousand tons of plates to various specifications, Colvilles at present requires the following characteristics in the equipment. For the primary scanning of the plate automatic indication of the presence of a flaw echo in excess of a pre-set amplitude is necessary. This prevents variation in the standard applied due to operator fatigue, if large tonnages of plate are being tested each day. It also prevents variations due to different operators applying the same standard in a slightly different way. The equipment must also signal when the amplitude of the return echo from the bottom of the plate fails to reach a minimum height. This fall in amplitude may be due to variation in the absorption characteristics of the plate or to poor surface contact. Some form of automatic control of the bottom echo amplitude is also desirable as this ensures that the flaw-warning circuit is always operating at the same pre-set sensitivity level relative to the bottom echo.

At the present stage of development of testing, manual operation of the probe along the grid lines is quite convenient and the defects indicated by the equipment are marked on the plate surface. The main difficulty in testing is to arrange that the set will indicate all flaws above a certain size, dependent on the standard of testing, and none below it. The "critical" size of defect at which the equipment can be set to discriminate is dependent on the size of the ultrasonic beam emitted by the probe, and this is in turn controlled by the crystal size.

Testing is generally carried out along grid lines at right angles to the direction of rolling and hence any flaws will generally have their major dimension at right angles to the scanning direction. The probe is moved across the plate so that that larger, crystal dimension lies along the grid line. If the grid line intercept of any flaw is much less than the major beam dimension the bottom echo from the plate will always be present and the size of the flaw will be indicated by the maximum ratio of the amplitude of the flaw echo to the bottom echo amplitude. The equipment will then be capable of distinguishing between a flaw of the critical size and one slightly larger or smaller.

If, on the other hand, the intercept made by the critical flaw is equal to or larger than the major beam dimension the bottom echo from the plate will be replaced by the flaw echo and the size of the defect will be determined by the distance travelled by the probe while the presence of a flaw is being signalled. In this event it is not possible to set the equipment to distinguish between flaws that are only slightly larger or smaller than the critical size, although it can be adjusted to ignore flaws much smaller than the critical size. Hence it can be seen that unless the probe is large enough

in relation to the critical defect size, the set cannot be made to indicate only significant flaws during the preliminary scanning process. Use of too small a probe may result in the indication of a large number of flaws. These defects will all have to be examined at a larger stage and many of them may be found to be less than the critical defect size and can therefore be ignored.

The authors proceed to describe the general procedure in examining plates and, referring to standards of internal quality, state that sensitive methods of examination now existing bring with them the danger that the standard asked for will be higher than that necessary in the interests of either safety or ease of fabrication and may become economically unjustifiable for large-scale production. A great deal of argument has arisen from time to time over such questions as what constitutes a lamination and when is a plate too dirty to weld. It has been the authors' experience that the answer varies according to the fabricating methods adopted, especially methods of welding, though the steelmaker is always interested in supplying a high quality product and will do all in his power to improve the standard of his material within the means at his disposal.

In spite of these difficulties, the Heavy Steel Association has produced a provisional standard of ultrasonic testing of steel plates, and in this respect it is believed to be in advance of manufacturers of other steel products.

The standard outlined by the authors can be applied to ½-in. plates and over.

Improvements in Plate Internal Quality

In general terms, the means of avoiding internal defects are to correct the possible sources of trouble. This is easier said than done, because when production records are examined it is found that in many instances there is no evidence of any single major factor that could be altered to improve at once the quality of the product.

Any improvement in the internal quality of plates by even stricter control of steelmaking and processing procedures would probably be marginal, and for a major improvement a radical change from normal practice would be needed, for example, the introduction of vacuum casting of ingots of plate steels in order to reduce the incidence of oxide inclusions. Such measures require expensive capital installations and it is pertinent to ask whether designers and fabricators are certain that the high standards of internal quality sometimes asked for are really necessary, and whether there will indeed by a continuing demand of sufficient magnitude for such products to justify providing the necessary specialized equipment in the steelworks.

SIR ALEXANDER FLECK, FRS, president of the Society of Chemical Industry, will open the Corrosion and Metal Finishing Exhibition to be held in the Empire Hall, Olympia, London, from November 29 to December 2.

British Iron and Steel Industry Translation Service

FOLLOWING is a list of some new translations available from the Iron and Steel Institute under its translation service scheme. Translations are all classified by numbers, and these should be quoted on application, which should be addressed to the institute at 4, Grosvenor Gardens, London, S.W.1.

1589: "The Attenuation of X-rays in the Wavelength Range $\lambda = 0.01$-$10.0\ \mu$." E. A. MÜLLER. Siemens Messtechnik, 1956, Feb., 37-38; May, 107-110. £2 15s.

1598: "The Lubatti Electric Process for Reduction of Ores." A. PECORARI. Radex Rund., 1954 (4/5), pp. 152-164. £3 5s.

1647: "Cleaning Steelworks Fumes." L. SEPTIER and P. LEROY. Publ. IRSID, 1958, Series A, Dec. (194), pp. 1-47. £9 10s.

1692: "High-temperature Precision Investment Castings." R. SCHWALBE. Stahl u. Eisen, Jan. 7, pp. 36-45. £6 10s.

1699: "Automation in Continuous Rolling-mill Trains." R. ZWICKY. ETZ-A, 1957, Dec. 1, pp. 869-873. £4.

1703: "Spectrochemical Analysis of Solutions by Spark Excitation. Application to Low-alloy Steel, Copper Alloys, and Slag." A. LARSSON. Jernkont. Ann., 1959 (8), pp. 508-522. £4 5s.

1727: "Embrittlement of Heat-resistant Austenitic Steels." G. KRÜGER. Neue Hütte, 1959, Dec., pp. 725-730. £6.

1728: "Investigations on the Embrittlement of a Heat-resistant Austenitic-ferritic Chromium-nickel Steel." H. SCHUMANN. Neue Hütte, 1959, Dec., pp. 733-738. £3 5s.

1757: "The Operational Value of Iron Ore." P. M. FOURT. Ann. Mines (Paris), 1958, Feb., pp. 93-111. £5 15s.

1774: "Effect of Piercing Mill Roll Variables on the Deformation Process and Occurrence of Defects in Tube Manufacture." O. PEJCOCH. Hutnické Listy (Prague), 1960 (2), pp. 157-166. £8.

1813: "On the Corrosion of Silica-roof Bricks with a Low Content of Fluxing Agents." S. KIENOW. Stahl u. Eisen, 1960, June 23, pp. 882-888. £5 10s.

1817: "Petrographic Factors Affecting the Reducibility of Iron Ores: an Attempt at Parallelization." H. SCHENCK and A. KÖNIGS. Arch. Eisenhüt., 1960, Apr., pp. 201-213. £8.

1941: "Forged Tool Steels for Hot Work." P. WAGENER. Rev. Tech. Luxembourg, 1958, July/Sept., pp. 157-179. £5 5s.

Steel Plant at Chanda

Chanda, in Msharashtra, India, will be the site for a steel plant, according to the Chief Minister of the State, Mr. S. K. Wahkhede. With a huge mountain of iron ore, there is no need for mining, he said. Chanda, which was the late Mr. Jamshedji Tata's first choice for a steel plant, will ultimately have the heavy industry to utilize both pig-iron and steel, the Minister said. The coal deposits in the region, nearer to Nagpur, had been surveyed, and against the previous estimate of only 17,000,000 tons, more than 300,000,000 tons of good quality coal were now available for exploitation.

CHALLENGE OF CHANGE

in South Derbyshire and Leicestershire

PRESIDENTIAL ADDRESS TO SOUTH MIDLAND COLLIERY MANAGERS

In his presidential address to the South Midland Branch of the National Association of Colliery Managers (May, 1960) Mr. T. W. Peters, deputy production manager (planning), No. 7 Area, East Midlands Divisional Coal Board, discusses the effects of the changes that have taken place in the industry with particular reference to the South Derbyshire and Leicestershire coalfields, where much of the output is consumed in power stations.

SOME five years ago certain of the larger countries of the world gave considerable attention to their future fuel and power requirements, and the situation in western Europe was summed up in the Organization for European Economic Co-operation report of 1956. Allowing for continued raising of standards of living, it was calculated that there would be a shortfall on future production of coal of some considerable magnitude.

In theory this would have been made good by imports of coal from America, oil imports, and nuclear energy. To deal with the latter point, it will be remembered that rather wild claims were made at that time both as regards the high rate of building nuclear power stations, and the low cost per unit of such nuclear energy. It has become increasingly obvious during the last few years that the original nuclear programme was too ambitious, and that even in 15 years' time the contribution of nuclear fuels is unlikely to exceed 8

By T. W. PETERS, B.Sc.(Hons.), M.I.Min.E.

per cent. of the total energy required. The cost of power from the larger conventional pulverized fuel coal generating stations has fallen considerably due to increased thermal efficiency and, therefore, the advantages of a limited amount of nuclear energy in the immediate future are far less attractive.

The last two years has seen a considerable extension in the use of oil at the expense of coal, both for general industrial and house-coal markets. We all know of the efforts to meet this competition which the National Coal Board has taken. Apart from technical considerations as to quality control, in the pit, coal preparation, etc., there is the great problem of flexibility as between summer and winter demand. The nature of our reserves and the conditions of employment of the labour force are such that flexibility is somewhat limited, and it is not possible to think in terms of, for instance, the American producing organizations, where total production has been directly geared to demand, producing for example, 562,000,000 tons in 1947, 350,000,000 tons in 1954, and 500,000,000 tons in 1956.

The less ambitious nuclear energy programme has already been mentioned in connection with the high efficiency of electricity generation from pulverized coal-fired stations. The CEGB run a league table of overall thermal efficiency for generating stations. In 1956, only two stations topped the 30 per cent. mark—they were Littlebrook (30.6 per cent.) and Drakelow "A" (30.5 per cent.). In 1959, 13 stations exceeded 30 per cent., headed by Castle Donington (33 per cent.). Included in the 13 stations are three of the new river Trent power stations, *i.e.*, Castle Donington, Willington "A" and Drakelow "A", which are in the first six of the league table. Among the larger generating stations, therefore, the increase in efficiency is of the order of 1 per cent. It may well be that with the progressive policy whereby the new base-load stations take a far greater share in overall energy generation, a 1 per cent. efficiency increase becomes general. When this efficiency increase is applied to an annual consumption of, say, 50,000,000 tons, the coal supply for the same electrical energy output would theoretically fall by 500,000 tons. This most desirable high efficiency will tend to reduce the coal demand forecasts, and the latest total demand figure is estimated to be 55,000,000 tons in 1965. In other words, while industrial production continues to increase, it will do so at a higher rate than, and out of proportion to the consumption of all types of fuel as expressed in coal equivalent.

Efforts have, therefore, been made to adjust production to the decline in demand which has taken place over the last two years. The problems for the immediate future depend on the extent to which oil continues to replace coal and the nature of the total demand for energy, bearing in mind the trend of higher standards of living, not only at home but also in countries to which we export the goods necessary to maintain our balance of payments.

It is now two years since the Select Committee on Nationalized Industries (Report and Accounts)

published its findings. Two matters in particular stand out when this report is examined in retrospect.

(1) On the magnitude of the NCB's task it was stated that any conclusions drawn from matters involving the general global position in terms of production, manpower and investment, must by their nature be generalizations, and the report went on to say that the committee considered that the policy of decentralizing as much as possible from control in London was wise since the responsibility and power for operating pits could not be retained in London.

(2) With regard to future planning, it was recommended that the 1956 plan "Investing in Coal" should be revised.

With reference to the first point, there has been little evidence of any decentralization. On the subjects of organization and staff, a great deal of thought has been given in both technical papers and at the NCB Staff College to problems at colliery level. However, there has been, strangely enough, little mention recently of the situation at Area, division, and headquarters. Might this not be a lull before a storm which would, among other things, modify circumstances arising from the implementation of certain recommendations of the Fleck report? Judging by the increased volume of inquiries from management at all levels in respect of information required by service departments, one could argue that centralization has increased—a tendency which hampers management at the very time when initiative is strictly limited by a tight "line policy."

Another illustration is with regard to manpower. In the last presidential address to the South Midland Branch of the NACM, Mr. J. R. Gibson highlighted the role of the industrial relations department. It is true to say that a national manpower policy has been followed which, coupled with the attitude of the national Press, has jeopardized the normal recruitment needs of certain districts, and which may well prejudice the future maintenance of an evenly balanced, though reduced, labour force.

To turn to the second point regarding future planning, the theme of this year's NACM conference was "The Challenge of Change," coupled with an examination of the "Revised Plan for Coal," published in October, 1959. Although the situation is vastly different to that of 50 years ago, the factors involved basically influence the outlook of all members of NACM, who would be inhuman if they were not intimately concerned with the critical issues at stake.

Expected Demand 1960-75

The established facts of immediate consequence are as follow:—

(*a*) CEGB policy on the river Trent generating stations has been clearly defined, and installations are proceeding as planned.

(*b*) The relatively lower grouped house-coal products properly prepared for the market have been in considerable demand during the past winter.

(*c*) In spite of oil competition, the industrial outlook is fairly healthy.

(d) Marketing departments are strengthening their organization and measures are being adopted to stiffen opposition to the threat of oil competition, by the introduction of capital loans, etc.

It is necessary to elaborate on the first point made above, with particular regard to the Drakelow station on the door-step of south Derbyshire. The "A" and "B" sections have already been completed and the total annual coal consumption is of the order of 2,000,000 tons, while the "C" section is due to be commissioned in 1964-65 and will consume some 3,500,000 to 4,000,000 tons. South Derbyshire and Leicestershire, therefore, will have to provide a considerable share of the Drakelow requirements. Inevitably this raises the subject of small coal demand, its availability, and proceeds.

While the national position is somewhat gloomy, these facts are reassuring—particularly so when viewed in the light of the very considerable stock lifting programme undertaken during last winter. The actual tonnage lifted in south Derbyshire and Leicestershire was over 300,000 tons. The annual output level has been running at approximately 7,000,000 tons and the lifting of ground stock expressed as a percentage is 4.5 per cent. Ground stocking ensures some flexibility, but it is costly and wasteful. However, possible measures to meet the situation are concentration of development work during the summer and double-shifting of mechanized faces during the winter.

Trends for Future Productivity

The "Challenge of Change" has already been actively followed up in many different ways, with the common objective of maintaining and reducing costs where possible. It is fair to say that at the majority of collieries matters concerning coal and dirt transport, manriding, and materials handling have been solved; therefore this leaves two particularly important problems needing constant review, which involve the tasks of increasing face o.m.s. and lowering materials costs at the face and elsewhere underground.

Face productivity potentials are considered in the light of power-loading experience and the South Midland Branch had the pleasure of recently hearing a paper by Mr. R. F. Lansdown, the chief mechanization engineer from NCB headquarters. While there is tremendous scope for mechanization, one cannot escape the fact that as reserves decline a great many collieries are faced with working seams under more difficult conditions, and so far no revolutionary mechanized system has been devised to overcome adverse geological factors, such as faults, washouts, weak floors, etc. This is all the more reason why these problems need solution.

In the south Derbyshire and Leicestershire coalfields there has been an average increase in face o.m.s. of 30 cwt. in the last 12 years and the power-loaded percentage has risen from 5 to 40. The most striking increase has been in the past

three to four years. During the last decade reconstructions have taken place to improve productivity elsewhere underground and on the surface—the majority of these schemes have improved clearance problems, thereby facilitating increased outputs. Output demands, as outlined in the "Revised Plan for Coal" is now likely to be stabilized, and, therefore, there is less scope in future for improvements in productivity other than at the face. To illustrate the effect of further increases in face o.m.s. Table 1 gives calculations, based on actual and anticipated results at a number of collieries, retaining the same overall output figures.

TABLE 1.—*Actual and Anticipated Results at Three Collieries in the South Derbyshire and Leicester Coalfield.*

Colliery.		Actual results.	Effect of increase in face o.m.s.	
			10 cwt. increase.	30 cwt. increase.
A	Face o.m.s. cwt. ..	96.1	106.1	126.1
	Overall o.m.s. cwt. ..	30.1	30.9	32.4
	Wages cost per ton overall	36s. 8d.	35s. 2d.	33s. 0d.
B	Face o.m.s. cwt. ..	97.5	107.5	127.5
	Overall o.m.s. cwt. ..	39.3	40.8	43.4
	Wages cost per ton overall	29s. 2d.	27s. 9d.	25s. 4d.
C	Face o.m.s. cwt. ..	113.3	123.8	143.8
	Overall o.m.s. cwt. ..	52.0	54.0	57.6
	Wages cost per ton overall	23s. 0d.	21s. 11d.	20s. 4d.

The calculations assume improvements of face o.m.s. only, without any change in performance or costs elsewhere underground and on the surface.

It will be seen from the table that an increase of 10 cwt. at the face gives an overall increase of 1 to 2 cwt., and that the total surface and underground wages cost per ton is lowered by approximately 1s. 0d. to 1s. 6d. The latter reduction in wages cost will be offset by an increase in depreciation, and certain other overheads together with additional maintenance and power costs in respect of the power-loading equipment which it is necessary to install; the net improvement will be in terms of pence, or fractions of a penny of a ton. Although these are apparently small net reductions in total costs, when calculated in terms of large tonnages, they reflect considerable additional profit. Increases in face o.m.s. of 30 cwt. are shown in the table to have the effect of reducing wages costs by the order of 3s. 0d. to 4s. 0d. per ton.

Magnitude of Tasks

Increases in face o.m.s of 30 cwt. or more are dependent not only on machines or techniques but also on the percentage of power loaded to total output which can be reached. Should there be continued restriction by thin seams, geological disturbances, etc., calculations have been made on the basis of a 50 per cent. power-loaded target with static o.m.s. at the face for the remaining conventionally won output. The result is that 10 cwt. increase in overall face productivity over and above the present figure of 125 cwt. could be achieved by an average mechanized o.m.s. of 184 cwt. and 30 cwt. increase would result from a mechanized o.m.s. of 284 cwt. It so happens that the last named figure is 10 cwt. higher than the four-week average of the current best eight working mechanized installations at the present time. This illustrates the magnitude of the tasks necessary for the 30-cwt. increase, but it is suggested that they are by no means impossible.

New machines and techniques may make it possible to exceed the 50 per cent. power-loaded figure even though adverse geological conditions exist. The effect of increasing the power-loaded percentage to 60 or 70 per cent.—assuming constant orthodox productivity of the balance of output—would necessitate minimum mechanized productivities of 222 cwt. or 192 cwt. to meet the target average figure of 155 cwt.

Future Investment Programme

Investment, although on the reduced scale envisaged in the "Revised Plan for Coal," is necessary to ensure the replacement of capacity by new mines, reconstruction of existing undertakings, expenditure on power loading and mechanization, and on the maintenance of existing plant. Inevitably this investment incurs increased overhead charges in the form of depreciation and interest. On a national basis the magnitude is of the order of 5d./ton/year in each case. Thus the investment overhead increases will be approximately 10d. per ton per annum, dependent on the output level.

This illustrates the point that any immediate short-term reduction in wages costs is likely to be offset by the cost of the investment programme. The only striking increase in productivity that can be achieved would be as a result of a rapid increase in the tempo of face mechanization. The "Revised Plan for Coal" makes it clear that the productivity and investment estimates do not "postulate new inventions and techniques of a revolutionary kind." Great Britain has led the world on numerous occasions in the scientific and industrial fields, and it would be taking a truly pessimistic view to aim at anything less than the national level of 31 cwt. overall productivity by 1965.

Significant advances in face techniques can be achieved by new revolutionary machines, together with systems of working which do not suffer from the inflexibility of the conventional longwall system. The steps necessary to achieve this objective should be quickly undertaken, and it is suggested that there should be a more concentrated research programme with complete co-ordination of activities both within and outside the NCB. At the present time, research effort has been expended and is being expended, on relatively less important matters such as lighting and tunnelling, and it is necessary for *all* efforts to be channelled into face mechanization with attendant problems of stables, roof control, ripping, etc., by the application of research

teams to actual mine working places at a considerable number of points.

It would seem important that the universities and larger technical colleges should contribute to a greater extent on face mechanization research effort, with direct coalfield liaison. With the smaller number of students undergoing training, both research and teaching staff would be more readily available. It has also been suggested that prospects of promotion are less favourable among the junior ranks of qualified mining, mining electrical, and mining mechanical engineers. Suitable persons could be made available from their numbers for practical research projects, thereby eliminating the need for calling in further numbers of scientists from outside the industry. The only other research work of equal importance is that in connection with future utilization of solid fuels.

Although it is impossible to escape the national position on investment overheads, there is no doubt that on individual schemes higher bulk tonnages are necessary from producing units as a whole within each scheme, and on any mechanization project it is necessary to seek the benefits of district concentration and automatically double-shift all production activities. Such a policy may accelerate the transfer of manpower from smaller relatively less profitable mines.

The magnitude of the task ahead is still more formidable in these circumstances. It is evident that in the intervening time, during which mechanization achieves considerable increases in productivity, both short- and long-term schemes to replace capacity are bound to show relatively low profitability, even though they reflect the high productivity of the best proved systems at the moment. Schemes to replace capacity which are really worthwhile, and in some cases essential, run the danger of being labelled "least profitable" due to the strict application of arithmetic, based on values which are continually changing.

It is submitted that investment to ensure continuity of productive capacity and maintenance of existing plant, should not be stinted, thereby safeguarding the national position, should difficulties be experienced in the supply of oil under conditions of an international situation which might involve price increases on the one hand, or on the other an interruption or even destruction of its availability. Criticism has so often been levelled at the lack of investment in coal in the past, and it would indeed be unfortunate if a situation developed which the coal industry was not in a position to exploit to its own advantage.

Summary and Conclusions

The questions already discussed lead to the following conclusions:—

(*a*) While of necessity there must be clearly expressed national policy, local management, whether at colliery, group, or Area, should be free to work within the framework of such policy, bearing in mind the widely varying circumstances between one coalfield and another.

(*b*) There is no reason to think that the revised investment programme can be considerably curtailed, since colliery output capacity has to be maintained and provision made for substantial expenditure on face mechanization.

(*c*) Immediate efforts to increase profitability and to reduce costs are vital during the present climate of relatively static demand to guarantee meeting increased overheads, arising from the continued investment programme.

(*d*) In the near future current increases in face profitability are not likely to effect overall cost savings of any magnitude when overheads have been taken into consideration, unless dynamic steps are taken to prove new machines applied to new systems of working. The whole of Great Britain's research effort must be concentrated and co-ordinated by mining engineers to this end.

The interpretation of the "Revised Plan for Coal" and the manner in which it is translated into board policy right down the line is, therefore, the concern of all the members of the association. The market outlook locally is bright, and there is no reason why morale should not be maintained at a high level and management continue energetically to meet the tasks that lie ahead.

Indian Iron and Coal Production

OUTPUT of coal in India in the first quarter of this year formed about 70 per cent. of the total value of mineral production, which is estimated at Rs. 373,000,000, compared with Rs. 341,000,000 in 1959, according to the Indian Bureau of Mines. An increase of 9 per cent. over the total value of production in January-March, 1959, was mainly due to higher coal and iron ore outputs. The output of iron ore, in fact, reached the peak figure of 2,600,000 tons, while the index of coal rose by 6.7 points.

Metallic production during the first quarter of 1960 was 41 per cent. higher than that of the corresponding 1959 period, the increase being largely due to the higher outputs of steel, pig-iron, aluminium, and copper. Pig-iron production during the period under review is returned at 1,057,000 tons and that of finished steel at 522,000 tons.

Exports of minerals from India during the first quarter constituted about 8 per cent. of the country's total foreign exchange earnings. Japan continued to be the principal market for Indian minerals, accounting for more than one-third of the total value. Of the mineral exports, iron ore (822,000 tons) was the leading commodity.

Iron-ore Deposits in East Ramnad

Prospects of the existence of iron ore in the Chettinad area in East Ramnad district and the forests in the Arimalam area in south India, several square miles in extent, are being investigated by the Geological Department of the Government of India. Iron ore mixed with quartz is said to be available in this area. Samples of iron ore from the area have been sent to the Director of Industries for analysis.

Metallurgical Progress

Some abstracts from recent reports on research and development, at home and abroad

The DHHU Process for Vacuum Treating Molten Steel. F. HARDERS, H. KNUPPEL, and K. BROTZMANN. (Journal of Metals: 1960, Vol. 12, No. 5, pp. 398-403). In the Dortmund-Hoerder Huettenunion process the heat to be degassed is tapped into a teeming ladle and transported to the treatment unit. The molten metal is forced into the treatment vessel in successive portions by a cyclic change in the immersion depth of the suction nozzle. After degassing, each portion of steel returns to the teeming ladle, thereby mixing with the balance of the steel, which has a higher gas content. The cyclic nature of the process establishes a definite relationship between the total throughput of molten steel and the required degree of gas removal.

An important requirement for effective operation is the achievement of high-flow rates through the nozzle. For example, for a three-fold recirculation from a 200-ton ladle, the rate of steel flow through the nozzle is 100 ton/min. The rapid recirculation of the steel produces thorough mixing, so, deoxidizing and alloying elements, although added late in the treatment cycle, are uniformly distributed throughout the heat. The degree of gas removal obtained at any time is indicated by the variation of the pressure in the treatment vessel. The oxygen content of the heat is known at all times during the treatment, and its final level can be controlled. The analysis can be corrected and/or maintained within very close tolerances by making additions in the treatment vessel. Semi-killed steels, with a low-carbon content, can be produced by this process.

Three Vacuum Processes Utilized to Produce Steels with Superior Properties. ANON. (Industrial Heating: 1960, Vol. 27, No. 4, pp. 776-778). The three general types of vacuum processes used in the United States for improving ductility, tensile and yield strengths, electrical characteristics, and surface quality of steels are:—(1) Induction melting; (2) consumable electrode-arc melting; (3) stream degassing. Vacuum degassing reduces non-metallic inclusions and harmful gases, so improving performances in highly stressed uses. Other advantages claimed are improved control of gas content and chemical composition, and reduced or elimination of heat treatment for some products.

In vacuum-induction melting, a high-frequency current passes through the induction coil and induces a secondary current in the steel it contains under vacuum. The heat generated melts the steel, which is free from contamination by atmospheric gases during charging, melting, and tapping. Consumable electrode-arc melting involves the melting of metal of a previously prepared composition. The electrode has an adaptor welded to one end for connection to a power rod. The rod suspends the electrode in the furnace over a smaller section of metal of the same composition in the ingot mould at the bottom of the vacuum chamber. An electric arc is struck between the two pieces of metal. The section in the mould is quickly melted and the ingot forms as the electrode drips into the water-cooled mould. The gases are drawn off by vacuum pumps. In stream degassing, the molten steel is exposed to a high vacuum as it is poured from a ladle into an ingot mould contained by the degassing chamber. The vacuum separates the stream of molten steel into droplets, while the stream flows to the mould.

Savings Through Exothermic Ferro-columbium. T. W. MERRILL. (Journal of Metals: 1960, Vol. 12, No. 5, p. 405). The addition of columbium, as ferro-columbium, to high-alloy steels is quite a critical operation. Ferro-columbium dissolves slowly in steel, and as it has a greater density than many alloys, the particles sink to the bottom of the furnace ladle. Also, ferro-columbium oxidizes readily when in contact with an oxidizing slag, or when exposed to air at elevated temperatures. After working with various exothermic mixes, it appears that a sodium nitrate—ferro-silicon type may be satisfactory. The ferro-columbium must be crushed to a screen size of −8 mesh, the sodium nitrate is mixed to the extent of 10 per cent. of the mixture weight, and 5 per cent. of ferro-silicon of −200 mesh size is added. An organic binder is also added.

Test results indicate that analyses of various heats showed that the columbium recovery from the exothermic mixture was above 90 per cent. The use of exothermic ferro-columbium as a ladle addition makes it possible to eliminate the furnace time required when using regular ferro-columbium. Also, the alloy mixture permits the steelmaker to take advantage of any residual columbium that may be present in the bath.

Stress-induced Strain Ageing. J. O. BRITTAIN and S. E. BRONISZ. (Metallurgical Soc. of A.I.M.E.: 1960, Vol. 218, No. 2, pp. 289-294). Experiments have been carried out to study the effect of an applied stress on strain ageing in steel. It was found that the stress-induced strain-ageing reaction proceeds rapidly in the temperature range 0 to 60 deg. C. The variation of stress-induced strain ageing as a function of plastic strain, time, and temperature is indicated. In all cases the strain ageing under conditions of stress relaxation is a linear, decreasing function of the plastic strain, where the plastic strains are within the region of uniform deformation, *i.e.*, prior to plastic instability. The capacity of steel to strain age continues well into the region of plastic instability. The activation energy for the stress-induced strain ageing

was found to be 10,000 cal. per mol. for the steel used in the investigation (C, 0.19; Mn, 0.89; Si, 0.05; P. 0.018; S, 0.035; Cu, 0.07; N, 0.002 per cent.).

Bright Annealing of Stainless Steel. ANON. (Steel: 1960, Vol. 146, No. 9, pp. 148-150). A vertical annealing furnace processes 60 ft. of 0.020 in. stainless steel strip a minute, in widths up to 48 in. Material from the hot-strip mill—about $\frac{1}{8}$ in. thick—can be rolled to 0.060 to 0.070 in., but it must be annealed to eliminate work hardening before it is reduced further. Bright-annealing methods are expensive, but with this new method of high-speed processing in the tower furnace bright-annealed strip should be available for most uses. Strip is drawn to the top of the tower, downwards over the upper furnace roll, and into the heating chamber. It is heated and cooled rapidly in a hydrogen or dissociated-ammonia atmosphere.

Molybdenum resistance-heating elements, backed by a high-purity alumina insulation system, permit direct radiation to the strip. In the cooling chamber, several blowers force hydrogen, at a high velocity, against the strip surface. The gas is blown in many streams, perpendicular to the path of the material in process. Heat-transfer rates are said to be many times greater than those of conventional coolers. The gas pressure inside the furnace is slightly higher than atmospheric pressure and so prevents contamination. Seals at the inlet and outlet prevent excessive gas losses. Extreme dryness is vital in the furnace atmosphere in order to keep the strip from spotting.

Flame Intensity Used as a Guide in the Oxygen-Steel Process. ANON. (Iron Age: 1960, Vol. 185, No. 16, pp. 156-157). At Jones & Laughlin's plant, basic oxygen steel is made in two refractory-lined furnaces which are used alternately. After charging, the furnace is rotated to an upright position, and an oxygen lance lowered to a set position above the bath. Oxygen, at 180 lb./sq. in. pressure, is turned on and there is rapid oxidation of silicon, manganese, and carbon. At the end of the refining period, the flame at the furnace mouth drops and the oxygen lance is raised, the furnace being tilted back to the horizontal position. The bath temperature is then checked with an immersion thermocouple. If satisfactory, the furnace is tilted in the opposite direction, and the steel is tapped. The flame-sensing element is a radiation detector mounted on top of the "pulpit," about 10 ft. from the top edge of the furnace and hood.

The detector responds to the amount of heat radiated by the flame, and focuses the heat energy through an optical system on to a small thermopile within the detector. By this means, flame radiation is transformed into a variable voltage which is plotted. Measurements are exact, and to aid this there is a small aperture in a steel plate mounted in front of the detector's optical unit.

Rivet Welding. ANON. (Steel: 1960, Vol. 146, No. 15, p. 100). In Russia several thicknesses of structural plates are joined economically with a burn-through method, which leaves a strong, rivet-like deposit. The machine used is like a drill press with a shaft passing vertically through guides or rollers. At the bottom, a chuck holds the power cable and a normal coated electrode. The top has a place for weights; and a simple ring is used as a stop. The electrode passes through a copper ring placed against the workpiece. At the start, a regular-coated electrode is mounted. Once an arc is struck a hole is fused into the surface of the workpiece.

There are two stages in the process, namely, piercing and refilling. The arc forms a molten pool bounded on top by the electrode, on the sides by the electrode coating. A stream of hot, ionized gases passes from the electrode and builds up a pressure which forces molten metal and flux to the surface. This creates a seal around the electrode, maintaining internal pressure. As the electrode penetrates deeper, more metal is exposed to the arc, permitting rapid penetration at fairly low currents. When it has reached a pre-set depth, the stop prevents further downward movement and starts the refilling stage. The arc length increases until it has reached the workpiece surface.

A Shake Method for Testing Pipe. ANON. (Iron Age: 1960, Vol. 185, No. 14, p. 93). Resonant-bending techniques reduce to minutes the time required to find out the probable years of service of metal pipe. For example, carbon-steel pipe fittings, with 0.5 in. wall thickness, can be vibrated to fatigue failure in less than 30 min. Steel pipe, about 10 ft. long, hangs freely from an overhanging steel beam. Points of suspension match the calculated node points. Under one of the points of suspension, unbalanced weights, geared to an electric motor, spin at a pre-set speed. They set up forced vibrations that induce a sympathetic vibration or "resonance" in the test pipe. The test piece "locks in" on its natural harmonic frequency and vibrates freely. Then the amplitude of vibration is increased by stepping up the motor speed The amount of amplitude of the pipe, obtained from strain gauges, is reproduced on an oscilloscope. The ends of the pipe are sealed, and the pipe is put under 10 lb./sq. in. air pressure during testing. The start of a fatigue crack through the pipe wall permits air leakage. A drop of 1 lb./sq. in. controls an automatic switch which cuts off the driving motor. A timing device permits the close measurement of the number of cycles to failure.

A Three-step Welding Method Speeds Repairs on Castings. ANON. (Iron Age: 1960, Vol. 185, No. 14, pp. 96-97). The area to be welded is "veed" out with a chamfering electrode. Grooves are made to break up stress concentrations around the "V." Then the anti-stress grooves are filled in with the sealing electrode. The entire area to be welded is covered with a thin deposit from the same electrode. The purpose of the second step is to prepare the surface for a strong bond between the cast iron and the final deposits. Then a machineable

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News from Australia

METALLURGICAL COKE PRODUCTION

IT was reported recently that Australia's first custom treatment plant for zinc, lead, silver, and copper would be established at Lithgow to treat ore produced in New South Wales. The managing director of the company concerned said experiments over recent months had convinced his firm that it was possible to make suitable metallurgical coke from western coal.

The Broken Hill Proprietary Company, Limited, and its subsidiaries increased the rate of steel production in March to an annual rate of 3,400,000 tons. March steel output was 289,300 tons, compared with 267,553 tons in February and 277,567 tons in January. Tinplate output was 8,418 tons in March, or 643 tons higher than February and 203 tons more than January. The annual rate of production of tinplate is now 101,000 tons.

Lithgow Smelters has erected a cupola near Lithgow gasworks for conducting large-scale experiments in connection with the production of metallurgical coke. The firm plans to manufacture pig-iron from scrap and iron ore, produce metallurgical or industrial coke on an increasingly large scale and, if experiments prove successful, manufacture high-grade steel.

Whyalla Plans to be Speeded Up

The establishment of a steel plant at Whyalla is to be speeded up to meet the heavy demand for steel, and it is hoped that the plant will be in production by 1965. Blast-furnace capacity will increase steel output beyond the earlier planned 400,000 tons per year. The Broken Hill Proprietary Company has asked the Government to step-up the Housing Trust programme in the area. The railway between Iron Knob and Whyalla is to be relaid and will be standard gauge.

Experiments in the use of low-grade ores are stated to have been so successful that it will no longer be necessary to rely on the relatively small tonnages of high-grade ore. South Australia has very large tonnages of jaspilite ore and investigations by BHP into its utilization are stated to be satisfactory. A discovery of a large deposit of high-grade lime sand has been made near Coffin Bay, on Eyre Peninsula, which could prove a very important industrial asset for the State. The Mines Department has been collaborating with Broken Hill Proprietary geologists in the search for high-grade lime deposits suitable for blast-furnace flux with powdery ores.

New lubricating oil refinery of BP Australia, Limited, to cost between £8,000,000 and £10,000,000, would be built at Kwinana, Western Australia, Mr. N. R. Seddon said recently. Mr. Seddon, the company's managing director, said Australian labour and materials would be used in the new plant "as far as possible." The Western Australian Minister for Industrial Development has stated that Laporte Titanium, Limited, is to send a team to Western Australia before the end of the year to re-examine the possibility of establishing a titanium oxide-producing plant at Bunbury.

Commonwealth Aluminium Corporation Pty., Limited, is considering the establishment of a 40,000-ton per year aluminium smelter on the east coast of Queensland. While primarily intended to meet the increasing Australian domestic demand, as oversea markets permitted, capacity could be extended by stages to 100,000 tons per year. The project would be based on Weipa resources. This project would be in addition to the plan to convert bauxite into alumina. Power resources are an important part of current investigations.

Peko Mines N.L. Tennant Creek, Northern Territory, has entered into a contract with Japanese buyers for the delivery of 30,000 tons per year plus or minus 10 per cent. of copper concentrates, equal to about 4,700 tons of refined copper. The period is for a minimum of seven years, with provision for extension. This arrangement reduces the cost of production, smelting, and realization of the company's copper much below similar costs available in Australia. But the company will now receive world parity price and lose the advantage of any higher internal Australian price and the copper bounty.

Preliminary work to test the commercial prospects of the Savage river iron-ore deposits is in hand. A trial shipment of 200 tons of ore is to be made from Burnie. The Savage river deposits are estimated at 200,000,000 tons. Diamond drilling has been in progress for some time. A diamond drilling programme was considered necessary to establish the continuity of the deposits and to ascertain whether they contain material deleterious to treatment.

METALLURGICAL PROGRESS

(Continued from facing page)

electrode deposit is laid down in a series of passes. This new method suits thin sections of heavy castings. As a joining technique, the method can weld cast iron to cast iron or cast iron to steel. A vital part of the sequence is in the third step, where back-step welding techniques should be used. Beads should vary between 1 and 4 in., depending on thickness. After each welding pass is deposited, it is immediately water quenched, so eliminating the time gap allotted for slow cooling between passes. Also, special preparation of the weld groove prevents the weld from distorting. This method is now undergoing widespread field tests.

Water Treatment and Recovery Plant

NOT unnaturally, the Abbey Works of the Steel Company of Wales, one of the world's largest steelworks, with an output of approximately 3,000,000 tons of steel a year, has a water problem. It became essential to recover as much as possible of the discharged water for re-use in the mill. In modern strip mills the quality of the water must be good, otherwise rolls will not last and minute indentations will be made on the steel strip which affect the quality of the finished work. Thus treatment plant for water recovery has to be carefully designed to meet this problem and to ensure that at all times the water quality desired is maintained.

The Paterson water-treatment plant illustrated successfully treats the effluent from the hot strip mill containing a large quantity of heavy suspended matter and oil, reducing the oil to a negligible quantity and the suspended solids to an average of 14 p.p.m. and on numerous occasions to 5 p.p.m. without filtration.

Six "Canals"

The hot returned effluent is pumped from the scale pits direct to a primary sedimentation tank, which is divided into six "canals," each about 100 ft. long by 15 ft. wide, equipped with electrically driven chain-operated flights or scrapers, the upper flights assisting in the movement of the rising oil to the skimmers and the lower scrapers lifting the heavy suspended solids up to a sloping wall to the top of the primary clarifiers, to be deposited on an endless belt discharging by chute to a railway truck for disposal. The oil skimmers, six in number, are adjustable according to the amount of oil contained in the water and discharge into a holding tank from whence the oil can be pumped away or removed by mobile tanker.

The effluent then passes through a Venturi flume where it is measured after which it proceeds to secondary circular clarifiers of the Centrifloc type, each 130 ft. dia. The Venturi flume is also used to control automatically the coagulants which are added to the water to assist in the precipitation of the lighter and colloidal impurities. The coagulants are brought by mobile tanker to the chemical house and discharged into holding tanks from whence they are pumped to the automatic measuring equipment. The coagulants used are waste products and these keep the cost of the treatment to a minimum.

FIG. 1.—PATERSON CLARIFICATION PLANT SHOWING CENTRIFLOC CLARIFIERS.

The Centrifloc clarifiers are of the vertical-flow type employing a modified sludge blanket with continuous sludge discharge. Their design is such as to ensure effective mixing and flocculation of the effluent before it is collected evenly over the upper surface of the clarifiers through radial launders equipped with hydraulically spaced orifices. Each clarifier has a mechanical mixer, mechanical flocculators, and sludge scrapers to remove the deposits formed on the floor of the tank, all the equipment being operated electrically. The design of the Centrifloc clarifier is such that the slurry discharge is kept to a very low figure and is as concentrated as is possible. In these works the slurry is discharged to waste without thickening, but, if necessary, thickeners can be incorporated and the sludge vacuum dried.

The plant was originally designed for a flow of 18,500 gall./min., but on completion it was found necessary to impose on the plant an overload of about 30 per cent. so that the final flow through the plant is of the order of 25,000 gall./min.

King's College Mining Society Journal

Contents of the latest issue (Vol. 28) of King's College Mining Society Journal, University of Durham, include an article on "The A.B. Longwall Trepanner at Vane Tempest Colliery." The authors are Mr. A. B. Burton (Anderson, Boyes & Company, Limited) and Mr. W. Forrest, "A" group manager, No. 2 Area, Northern (N & C) Divisional Coal Board, who was formerly manager at Vane Tempest. Prof. Yoshio Hiramatsu contributes an article on "The Fracture of Rock Around Underground Openings," while Mr. J. C. R. Weeks (Hugh Wood & Company, Limited) writes on "Large Outputs."

MINE MECHANIZATION IN N & C DIVISION

HM Inspector's Comments

MECHANICAL methods of coal production are referred to by Mr. H. F. Wilson, HM Divisional Inspector of Mines for the Northumberland and Cumberland Division, in his report for 1959 under the Mines and Quarries Act, 1954. He states that there has been considerable increase in the number of faces equipped with self-advancing hydraulic chocks and there are several more installations planned to go into service in the near future.

While he believes conditions in the coalfield are often suitable for installations of this type, it is important, he urges, that close attention to detail should be given during their installation and subsequent operation. In particular, the cantilever roof supports must make effective contact, otherwise, in practice, they cannot support the roof between the chock and the coal face no matter how well they may look on a drawing.

The inspector says there was a further fall in the demand for coal, and this affected the Northumberland and Cumberland Division in common with the rest of the country. The closure of five small collieries was implemented early in the year, but output continued to exceed sales and large stocks of coal were put on the ground. These steps enabled all collieries to work regularly, but the position was still extremely difficult, and at the end of the year, further closures were planned for the first quarter of 1960, while output is to be reduced at several other mines.

Changed Market Conditions

The change in market conditions has encouraged schemes which produce a cheap low-grade coal suitable for power stations, and this has, in turn, encouraged the use of power-loading machines, such as shearer loaders and coal ploughs, even though it is necessary in some cases to cut into the floor of a thin seam. Loading machines incorporating hydraulic location jacks, which can be used with the conventional support system, were used in increasing numbers and there were 49 of these loaders in use during the last quarter of 1959. Twenty-one coal cutters adapted for flight loading were also in use.

Table 1 gives a summary of the numbers of persons killed or seriously injured during 1959 and a comparison with the averages for the preceding three years. Table 2 shows the incidence of the accidents in the two districts forming the division.

TABLE 1.—*Persons Killed or Injured at Coal Mines during 1959 Compared with the Average for 1956-58.*

	Killed.		Seriously injured.	
	1959.	Average 1956-58.	1959.	Average 1956-58.
Underground:				
Falls of ground:				
(*a*) At the face	6	6.7	55	40.7
(*b*) On the roads	3	2.7	3	3.3
Haulage and transport ..	7	2.0	31	26.0
Gases, coal dust, and fires:				
(*a*) Explosions	—	0.7	—	0.4
(*b*) Others	1	—	—	—
Machinery	—	0.3	3	3.0
By explosives	—	0.6	4	3.3
Other underground accidents	1	1.0	4	4.0
Total underground	18	14.0	100	80.7
In shafts	—	1.0	—	0.3
Surface accidents	1	1.7	7	9.0
Total	19	16.7	107	90.0

TABLE 2.—*Incidence of Accidents in the Two Districts Forming the N & C Division.*

District.	Persons killed.		Persons seriously injured.		Total.	
	1959.	Average 1956-58.	1959.	Average 1956-58.	1959.	Average 1956-58.
Northumberland ..	18	12.0	98	78.7	116	90.7
Cumberland ..	1	4.7	9	11.3	10	16.0
Total	19	16.7	107	90.0	126	106.7

There were no fatal accidents to young persons, but five were injured underground and one on the surface. One lad was injured when illegally riding on a tub haulage and another when he jumped from the leading cab of a moving locomotive in order to run forward and change the points. He slipped and was run over. This, states the inspector, is another illustration of the way in which boys are encouraged to adopt bad practice by experienced men who should know better.

Falls of Ground

Accidents from falls of ground represented 53.2 per cent. of all killed or seriously injured. In those cases where the investigating inspector considered the accident to be avoidable it was too often the case that not only was the injured man doing something which he was prohibited from doing by the Regulations, or by the ordinary rules of good practice, but that it was extremely unlikely he was doing it for the first time.

Three fatal accidents and one serious non-fatal accident occurred during salvage operations in old roadways. With the closing down of so many mines at the present time, it is pointed out, this

work assumes new importance and as it is so easily open to the adoption of bad and dangerous practices, the subject has been covered by a Code of Practice issued by the Northern (N&C) Divisional Coal Board. This is in booklet form with the title "Withdrawal of Roadway Supports." A copy has been issued to all workmen and officials concerned with this work. The booklet deals with proper equipment and methods and, if properly observed, should do much to reduce the likelihood of this type of accident taking place. In the four cases mentioned there was failure to observe recognized good practice in roadway support withdrawal. The issue of the new Code of Practice is only the beginning. Managers and officials must see that those engaged in the actual withdrawal understand the Code and are provided with the proper tools and equipment to carry it out.

Some 30.2 per cent. of all killed or seriously injured come under the heading of accidents from haulage and transport. A non-fatal accident draws attention to the need for the haulage arrangements on coal plough and shearer loader faces to be properly designed and checked by engineering staffs. In this particular case a coal plough on a prepared coal-plough face in a seam 6-ft. thick was operated by a double-drum hoist fitted with an adjustable friction clutch. The haulage ropes were attached to the plough by socket and links. When the link on the socket fractured, the tension was suddenly released and the socket and rope flew back and struck a man 38 yd. along the face, fracturing both arms. The investigation revealed that the adjustable friction clutch had been tightened to allow slip at a load which subjected the attachments to severe overload and resulted in fracture. It is emphasized that suitable safety devices must be incorporated in the haulage arrangements used with all coal-getting ploughs or loaders, otherwise, there is a danger of the attachments failing due to overload.

Three of the fatal and 12 of the non-fatal accidents occurred at conveyors and gate-end loaders. Two fatalities occurred at gate conveyor gearheads at transfer points within a few weeks of one another. In each case a man had his arm amputated when it was drawn past the side plate and then between the top belt and the delivery drum. All such gearheads, states the inspector, should be examined most critically to see whether it is possible for a similar accident to occur. While the side plate may appear to offer some protection in the way of secure fencing, it may be necessary to enlarge the side plates so that the delivery drum is put beyond the reach of a man's outstretched arm.

VISUAL SIGNALLING SYSTEMS

for Underground Locomotives

MANY locomotive haulage systems have been, and still are, in operation without the use of signalling equipment, and, in fact any locomotive system can operate safely without signalling if the traffic moves at a sufficiently slow speed and all drivers are sufficiently vigilant. Basically, therefore, the purpose of signalling is to improve the efficiency of the haulage system through better utilization of locomotives and manpower.

Underground locomotive haulages may be controlled by a system of visual signals, as is the practice on public railways, or by telephonic communication between the locomotive driver and a central control point. The latter, in the form of a radio-telephone, is at present undergoing development, and experimental installations are in use. However, the stage has not yet been reached where its full possibilities are known. It seems unlikely that in the case of the more complicated transport systems it can provide a degree of safety without the use of other equipment.

Visual signalling systems are considered in information bulletin No. 60/218, issued by the National Coal Board's production department. The bulletin discusses the purpose, aims, and means of signalling, describes the commercially available systems and equipment, and compares the cost of the systems described.

When considering a locomotive haulage scheme, the signalling requirements have frequently been neglected, or at least not adequately covered in the early stages. Since signalling equipment may cost a considerable sum if the system is at all complicated, it is desirable that this subject should receive as much attention as the locomotives themselves. It is, however, difficult to say in general terms in what circumstances signalling is necessary or justified, and if so what is the preferable system. So many factors are involved that it is better to consider each case on its merits.

Nevertheless, no signalling would be necessary in the following circumstances:—

(*a*) If no more than one locomotive is permitted to operate over the section of track under consideration.

(*b*) If in cases where more than one locomotive operates on a section a rigid system of timing can ensure that only one is in the section at a time.

(*c*) If visibility is sufficiently good, having regard to the speed of operation, to permit operation by manually visible means. This condition may apply in pit bottoms and even on the open line, provided that obligatory dead-slow running could be enforced at junctions.

Generally speaking, some form of signalling is justifiable if none of these conditions apply, but the system adopted must depend on the facilities required, having due regard to the relative costs.

W. M. THORNTON LECTURE

THE COMPLETELY MAN-LESS COAL FACE

MR. B. L. METCALF

THE completely man-less coal face has long attracted the mining engineer. One of the most difficult problems is to get the power-loading machine or plough to steer itself. A "coal-sensing" probe has been devised by the National Coal Board's Mining Research Establishment (MRE) to help to guide power-loading machines and the technique was demonstrated by means of film by Mr. B. L. Metcalf, NCB director of engineering, in the course of the twelfth W. M. Thornton Lecture, delivered to the Association of Mining Electrical and Mechanical Engineers at its Blackpool convention this year (IRON AND COAL, June 24, 1960, p. 1427).

The probes use a measurement of the intensity of gamma rays scattered back from the floor of the coal seam to determine the thickness of coal left on the floor by the machine. In one application the machine will have a sensing probe in the leading end of each of the two skids on which it runs. The probe units are to be connected to individual meters (calibrated in inches of coal) at the rear of the machine, so that the operator can tell at a glance if the machine is tending to cut into the roof or floor at either side, and correct any such tendency by means of the four hydraulic jacks connecting the body of the machine to the skids. It is hoped to try out this equipment at New Lount Colliery (East Midlands Divisional Coal Board) this year. Once the principle has been proved underground by these trials it is intended to take the obvious next step of using the signals from the sensing probes to control the jacks automatically.

Use in Very Thin Seams

Mr. Metcalf suggested that this device, when perfected, will be of great advantage to a machine like the Durham Continuous Miner. Now being developed for use in very thin seams, the machine is designed to drive headings in coal of such a size and shape as to be self supporting. It consists of a cutting head comprising two augers and a cutter chain which is pushed into the coal from the roadway by means of push rods and which carries with it an extensible conveyor system to carry the cut coal back into the roadway. The necessary thrust to push the machine into the hole is developed by a large hydraulic cylinder mounted on a launching platform which also accommodates an angle station and the controls. The conveyor associated with the system runs from the back of the cutting head and through the angle station and incorporates an increased length of loop take-up in order to "follow" the machine. The main problem at the moment is the need to apply some form of steerage, but the machine promises great advantages, particularly in the form of a high face o.m.s. from thin seams.

Also demonstrated by Mr. Metcalf in the course of his lecture was a system of remote-controlled self-advancing roof supports devised by the MRE. One operator, stationed at an electronic control unit, can advance a series of 256 chocks individually in any sequence he may choose. Alternatively, he may set the control unit to advance the chocks in a set sequence without further attention from himself. If, however, a chock develops a fault or becomes obstructed in its advance the automatic control stops the sequence and gives an alarm to the operator. From the indications on the panel he can usually determine the nature of the trouble and decide whether to over-ride the stoppage and allow the sequence to continue or to visit the face and clear the fault.

The essential items of equipment added to the chock in this system are an electro-hydraulic valve, a pressure transducer, and a ram-extension transducer. The electro-hydraulic valve causes the props to be released and the chock to move forward in response to an electrical signal from the control unit; the transducers send back signals which indicate when the chock is advanced to the required extent and the props are set against the roof. On receiving satisfactory indications from the chock the automatic control circuits pass the advancing signal to the next chock.

If an exclusive set of wires were provided from each chock to the control unit the size of the face cable would be prohibitive. A scheme has been developed, however, for reducing the total number of wires along the face to 25 without sacrificing the ability to control and monitor any of the 256 chocks individually.

Five of the wires are for the control and monitoring signals and are connected to each chock through an individual transistorized relay mounted in a junction box on the conveyor. The remaining 20 wires are classified into three groups of 8, 8, and 4.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

COAL FACE DUST EXTRACTION

To the Editor of IRON AND COAL

SIR,—The article published in your issue of July 15 refers to the early stages of a research programme on dust catching by collectors mounted on continuous mining machines in the United States. No results of this work are yet available.

In the UK, a dust collector using the principle described in your article has been used in conjunction with a continuous miner at Easington Colliery. It is 9 ft. 9 in. long (excluding fan), about 2 ft. dia. and 3 ft. 1 in. high (including sump unit). It handles between 5,000 and 7,000 cu. ft./min. at a pressure drop of 5 in. water gauge (6,000 cu. ft./min.).

Following the improvement in working conditions, further installations are planned. The next two units, of the latest design, will be capable of cleaning greater quantities of air (12,000 cu. ft./min.) than the first installation. (Units may be between 2,500 cu. ft./min. and 64,000 cu. ft./min., although the larger units are clearly unsuitable inbye.) These units are not designed for mounting on continuous miners.

The machine referred to in the article as the "Joy Manufacturing Company's latest model" is specially designed and does not operate in the same way as the above collectors. It is still in the course of development at the company's experimental mine.—Yours faithfully,

G. R. SCHRAGER.

Joy Sullivan, Limited,
7, Harley Street,
London, W.1.
August 26, 1960.

MINERS' HOURS

To the Editor of IRON AND COAL

SIR,—I cannot see what is exactly in the mind of your correspondent, F. Colin Swallow, except that he wants the miner to spend more time per day at the face producing coal. Really what is required is more time turning and cleaning coal. On a 7½-hour shift, the coal-face miner spends about 6 hours in coal getting.

The average number of shifts made per week is nearly 4½, and certainly no more than 225 per year, for which they are paid 290 shifts as wages, and which increases the selling price of British coal at the pithead to an average of 84s. 3d. per ton. It is well to remember that in 1959 the output per man year was only 294 tons, with 100 per cent. mechanization, while in 1937, 309 tons per man year were produced with only 55 per cent. mechanization, which included very little power loading.

Nearly the whole of the 309 tons per man in 1937 was large coal, judged by the standard of large coal fixed by the NCB today, and sold at a pithead price well below 16s. per ton. If we compare the rise in wholesale and retail prices today with 1937, we find that the prices are three times higher—so that at the outside, pithead prices should not be more than 48s. per ton.

Surely, when we recall that the previous coal owners in the 1937 period had to find all their own capital, and the NCB have only to dig out of the capacious pocket of the exchequer, which has already found over £1,000,000,000, is it not time for the NCB and the NUM to think a little about the British coal consumer and taxpayer, rather than complain about industrial and domestic consumers looking seriously at alternative fuels?—Yours faithfully,

SAM F. MIDDUP.

14, Hucknall Road,
Newstead Colliery (Notts).
August 27, 1960.

Minerals Engineering Course at Birmingham

PUBLISHED by the Birmingham University Mining Society, Mining Technical Magazine for 1960 contains articles on various topics, including some of a less technical nature than have appeared in previous issues. Aspects of the future of the university are outlined by Prof. S. G. Ward, head of the Mining Department, who states that although the Mining Department is not likely to expand, a new course leading to a degree in minerals engineering, is to start in October. The object of the course is to provide for the minerals industries graduates who have the outlook of the pure scientist with the attributes of the engineer. To accommodate this new addition the name of the department has been changed to the Department of Mining and Minerals Engineering.

A paper on reconstruction, by Mr. W. V. Sheppard, director-general of production and reconstruction for the National Coal Board, reviews the provision of new capacity by opening up new collieries and reconstructing those collieries where the present facilities do not enable the maximum output to be obtained. "Training Within Industry for Managers," by Mr. J. M. Pike, describes the task of taking over a new appointment. Other papers in the magazine are connected with coal preparation. Prof. A. A. Battaglia, of the Academy of Mining and Metallurgy, Krakow, Poland, considers the application of centrifugal force in coal preparation. Dr. A. A. Hurst, deputy director (coal preparation), Central Engineering Establishment, National Coal Board, discusses the problems associated with the development of coal preparation techniques.

Non-destructive Testing in Electrical Engineering

The Measurement and Control Section of the Institution of Electrical Engineers, in association with the British National Committee on Non-destructive Testing, is arranging for a conference on non-destructive testing in electrical engineering to be held at the IEE, Savoy Place, London, W.C.2, from November 8 to 10, 1961. Theme of the conference will be "How Best May the Electrical Engineer Test the Quality and Endurance of his Materials and Structures?" Full details may be obtained on application to the secretary of the IEE.

ROLLING OF FREE-CUTTING STEEL

into Square Sections

This is a translation of a paper in Metallurg (No. 4, April, 1960, pp. 30-31) in which P. P. Zuev, manager of the No. 1 rolling mill at the Elektrostal' Works, describes improvements made in the rolling practice for free-cutting steels.

FREE-CUTTING steel is classed among those steels which are difficult to work mechanically, for they have a narrow plastic temperature range. The production of square sections of small and medium dimensions from 8 to 40 mm. from free-cutting steels in continuous mills presents considerable difficulty. In order to produce squares of the correct shape without corner cracks great importance attaches to the correct choice of the shape of the work roll passes, and of the system of rolling.

At the Elektrostal' Works it was formerly the practice during the rolling of free-cutting steel R18 to use a diamond—diamond roll pass design in the roughing stand, and a diamond-square system on the finishing train. During the rolling of the stock in the diamond and square passes no further work was done on its corners, and with the decrease in the section of the stock the corners became sharper, which led to their cooling down to a marked extent and a sharp drop in plasticity. Metal rolled in accordance with this system produced a considerable amount of scrap during final grading on account, of course, of cracks on the corners. Changes were therefore introduced in the rolling technique: intermediate heating was introduced, and in the first stand of the finishing train the diamond and square passes were replaced by a flat box and a round pass, respectively.

In accordance with this technique an 85-mm. square billet was rolled into a 40-mm. square section, which was then cut on press shears into lengths not exceeding the width of the furnace and delivered into a furnace located in the immediate vicinity of the first finishing train. After this the semi-finished billet was rolled to the final dimension in the finishing stands of the mill.

Rolling with a flat box—round pass system in the first stand of the finishing train made it possible to displace rapidly the cooling corners of the stock towards its sides, and thereby establish an even temperature over the cross section. Rolling was completed within the plastic temperature range of free-cutting steel R18, *i.e.*, 950 to 900 deg. C. The square section was produced without cracks on the corners. But the technique adopted led to a reduction in the output of the mill, to an increase in metal losses in the form of scale, and to an increase in the thickness of the decarburized layer. In addition, the use of a round pass as a leader to the finishing pass did not ensure the production of a square with sharp corners, for two of the opposite corners of the square were blunted.

Operatives at the works have developed a new system of rolling in the roughing stand, which is free from the disadvantages indicated above. This is a combined system of diamond—diamond—oval —round—diamond—diamond (see Fig. 1). Rolling into the finished section on the finishing train is carried out in accordance with a diamond-square system.

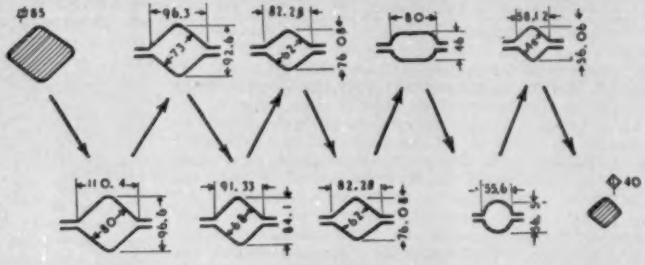


FIG. 1.

Operation with this system gave good results. Replacement of the two diamond passes by an oval and a round pass produced the result that the corners of the previous diamonds which cooled down rapidly were displaced first of all to the sides of the oval and then to the top and bottom of the round, and on delivery into the following diamond passes the corners are formed at different points. In addition, during the passage of the 62-mm. square stock through the oval roughing pass of 80 by 46 mm., it heats up noticeably.

Rolling in accordance with the new system, which has done away with the use of intermediate heating, and maintained the same number of passes in the roughing stand, has made it possible to increase the output of the mill, eliminate corner cracks, ensure sharp corners on the square, and considerably reduce scrap due to decarburization.

Pakistan Steel Plant Projects Nearer

ESTABLISHMENT of two steel plants, one in East and one in West Pakistan, seems now to be within sight. Koppers of Pittsburg, in the US, has submitted its feasibility report on the 250,000-ton plant for Karachi and so has the team of Japanese experts investigating the 100,000-ton plant for Chittagong (East Pakistan).

The two reports are under the examination of the Pakistan Industrial Development Corporation, the sponsor of the project. Of the two outside interests, Koppers is understood to have agreed to instal the plant while the Japanese consultants have indicated the feasibility of the venture both technically and economically. Representatives of Koppers are due in Pakistan shortly to negotiate details with the PIDC.

The two plants, with a combined total capacity of 350,000 tons a year, will be based on imported pig-iron and scrap, and will be able to meet 70 per cent. of the requirement of the country until the last year of the Five Year Plan (1965). They are in fact pilot plants for the integrated steel plant which the country eventually plans to instal.

The Government is also consulting at the same time Krupps, in respect of that concern's financial participation in the steel ventures of the country.

Swedish Steel Industry Expansion

SALES of finished products by Uddeholm AB, the Swedish steelmakers, last year rose to 107,000 metric tons from the 1958 figure of 88,000 tons. The output of rolled metal increased from 262,500 tons to 312,500 tons over the year. In view of these increases the company is to expand capacity.

Most of the group's ferrous metal is supplied by a subsidiary, Degerfors Järnverk AB, and in 1962 this company is to open a new coarse plate mill which is now being built at a cost of Sw. kr. 30,000,000. At Hagfors the production capacity for tool steels and stainless steel will be increased when a new arc furnace, now under construction, is brought into operation. The increased demand from the motor industry has led the company to expand its production of spiral springs at the Munkfors cold rolling mill.

Ruhr Steel Firms Tackle Problem of Alcoholism

MANY Ruhr workers, and especially miners and steelworkers, are in danger of becoming chronic alcoholics. Welfare organizations are engaged in a re-education campaign in an effort to cut down a dangerous increase in alcohol consumption in the area. At the suggestion of the welfare organizations, one German steel firm spent £3,300 last year on providing its 5,000 workers with free tea, to take the place of alcohol. Another steel plant bought up and closed 25 small "drinking dens" which had opened up inside the factory grounds.

Alcohol consumption is rising steeply in West Germany as a result of the prosperity boom. The local advisory centre in Bochum in the Ruhr has nearly 2,000 alcoholics on its books, most of them miners. In Dortmund, over 1,000 are undergoing treatment.

Tasmanian Aluminium Plant Changes Hands

NEW company comprising the Consolidated Zinc Corporation (two-thirds interest) and the Tasmanian Government (one-third) with a nominal capital of £A10,000,000 is to be formed to take over the Bell Bay aluminium plant in Tasmania as a going concern. It will expand its capacity from 12,500 ingots a year initially to 28,000 tons at a cost of £A9,400,000. Later the aim is to expand capacity to between 40,000 tons and 50.000 tons a year.

The Bell Bay plant has been operated since 1955 by the Australian Aluminium Production Commission set up by the Australian and Tasmanian Governments. Total capital investment by the governments has been over £A11,000,000, and the Commission's profit in 1958-59 was only £A159,000. The present scale of operations has not made it possible for the Commission to pay interest to the partner governments as was originally envisaged.

The amount offered for the undertaking by Consolidated Zinc and the Tasmanian Government is £A10,970,000 with a down payment of £A2,500,000 and the remainder payable by instalments over 16 years.

Japan Plans Trebled Steel Output of 49,000,000 Tons

JAPANESE steel industry is considering a plan to more than treble its steel ingot output to 49,000,000 tons a year by 1970, a spokesman for the Japan Iron and Steel Federation said last week. This would make Japan the third largest steel producer after the United States and the Soviet Union, he added. The plan makes an upward revision of a previous project announced last year to expand the steel ingot production to 38.000.000 tons by 1970.

During 1959 the Japanese steel industry produced 16,623,000 tons of steel ingots, which showed an increase of 37 per cent. over 1958. By this increase, Japan became fifth among the world's steel producing nations.

The spokesman said the new plan would probably be finalized after consultations with the Japanese Government.

Stalin Ironworks Town as Communist Showpiece

EAST GERMAN town of Stalinstadt, built 10 years ago around the J. W. Stalin iron combine, recently held a festival in which the town was presented as an example of Communist progress. East German authorities described the people of the town as "new Socialist people, who love their Socialist work and their Socialist town with all their hearts." Some 70 per cent. of all the women in the town go to work.

The centre of the town's life, the ironworks, now produces 1,120,000 metric tons of pig-iron annually, or two-thirds of the national output. Although £165,000,000 has already been invested in the combine, which is soon to have a steelworks and rolling mill, State subsidies have to be made to the plant owing to its geographic position.

THE COAL TRADE

DEMAND for house coal has strengthened since the resumption of work at the pits following the annual holidays, and tonnages are being more rapidly taken up. Most grades of domestic fuel have been reasonably plentiful, but in some areas merchants have had to lift depot stocks to meet with the flow of orders, and there has also been some lifting of colliery ground stocks. There is a greater interest in industrial fuels, with regular consumers taking supplies steadily and a better demand from seasonal users.

DURHAM AND NORTHUMBERLAND

Collieries are having to team output on the ground because of the unofficial seamen's strike and the hold-up at North-East coast ports of coastwise fuel despatch. More than 120,000 tons have already been teamed.

In the meantime, power stations and gasworks in the London and South Coast areas usually supplied from this region have had to draw on their own stocks. Settlement of the strike would mean an early and considerable despatch of coal because at the principal shipping places colliers lying idle are already loaded. Staggered colliery holidays are ending and that, together with the good output figures being attained generally in both counties, is aggravating the difficulties of output disposal.

The tone of the market, so far as forward business is concerned, remains encouraging and good class Durham and Northumberland large and graded steams and Durham gas and coking coal have quite a welcome volume of trade on the books. Industrial cokes find a very steady trade and general oversea trade for cokes also maintains improved figures.

SCOTLAND

Glasgow—A rather more active trade is evident in the domestic market, due to the poor summer weather. The effect of this was underlined during the four main holiday weeks from the middle of July to mid-August, when consumption totalled 179,000 tons compared with 128,000 tons last year—a rise of 40 per cent. Merchants are convinced that the extra tonnage has been burned and was not stocked.

The choice of coals is narrowing, but the board is still putting some friable ones on the ground as merchants continue to shun these. There is little doubt that large coal will again fall short of winter requirements and that doubles will be filling the gap. Sales of these are already higher than last year, especially in the pre-packed form. Current supplies include group 5 as well as group 6, the sole offering a year ago.

In the industrial sector a strong demand is being maintained for coking smalls, supplies of which are still comfortable, and more interest is also being shown in singles and pearls. Washed smalls are clearing steadily, particularly to electricity works, which are also absorbing good tonnages of untreated smalls. Outlets for duff are more or less sufficient to clear supplies. Anthracite nuts are at brisk trade again, but beans show little improvement. Large is very comfortable as usual at this season, but duff is moving away well, with much of it finding its way exportwise. A heavy demand for metallurgical coke is being met without trouble.

Fife and Lothians—The standard of fuel for the market has been improved by the introduction of the new washer at Wellesley Colliery, but it has helped to put Fife trebles "off the market" by their inclusion in large coal. Demand all round is increasing slowly, with the volume of shipments slightly higher than a year ago.

SOUTH-WEST LANCASHIRE

Increase in the demand for house coals has been more pronounced during the past week and there has been a marked increase in the numbers of orders received at the depots. Most merchants report that their order-books are now looking better than at any time since last March. With Colliery holidays nearing an end supplies of practically all grades are readily available with the result that merchants are able to give prompt despatch to household orders. "Coalite" continues to command a steadily increasing market and at present supplies are being satisfactorily maintained although it is doubtful whether production will be able to keep pace with demand later in the year. There is more interest shown in anthracite stove nuts but deliveries are not as good as in recent weeks.

In the gas coke market there has been little revival as far as domestic demand is concerned, but there is more interest in buying for central heating purposes. Industrial demand for small sized hard and gas coke remains good and there is also a very steady demand for all other industrial fuels on allocation which are coming forward steadily.

Coastwise trading from the Merseyside docks remains quiet with some slight extra interest being shown in the demand for house coals for Northern Ireland and the Isle of Man, although unfortunately business to Eire remains very slow.

The prices, per ton, of house coals now in force are as follow: Group 1, 182s. 8d.; Group 2, 163s. 3d.; Group 3, 146s. 5d.; Group 4, 134s. 8d.; Group 5, 121s. 7d.; Group 6, 11s. 5d.; Group 7, 97s.

Coal Chartering

AMERICAN coal market is quiet and from the Hampton Roads area the main inquiry is generally centred on Japanese discharge. For August, 12,000 tons 5 per cent. was fixed to Japan at $8.20, following 7,000 tons for late August at $8.05. For late January/February $8.40 is reported paid for 14,000 tons. There has been some demand for Brazil and the lower Plate, the former paying $5.25 for September/October, basis Rio, and to Buenos Aires October/ November has fixed at $5.70. Other fixtures include Hampton Roads/Lisbon 11,000 tons for late August/September at $4.25, and 6,400 tons to Cork for late August/September at $4.35.

Inquiry from either east or west coast UK to the Mediterranean area is only moderate, but Wales/West Italy reports a fixture of 4,000 tons for November/December at 24s. 9d.

Workers in Industry "Paid for Frustration"

"TO give thought and attention to people's morale and attitude to work is straightforward commonsense. It is ludicrous to have perfect equipment and indifferent men working it." Apprentices at the industrial Welfare Society's conference in Oxford were told this by Mr. John Marsh, the director, on Tuesday. Because of the way modern industry was organized, he said, many workers were being paid not for the work they did, but for the frustration they had to put up with.

A revolution in thinking by employers and workers was needed if industry was to benefit from increasing technological advances, he maintained. Other industries would suffer the same fate as the cotton industry unless they revolutionized their standards of manufacture. The chief trouble was the resistance to change of both men and women, he added. "If men are going to resist changes, it is going to be difficult to benefit from technological advances and people will resist a change unless they are consulted."

Ore Preparation Plant for Appleby-Frodingham

ORDER has been received by Head Wrightson Iron & Steel Works Engineering, Limited, a subsidiary of Head Wrightson & Company, Limited, from Appleby-Frodingham Steel Company, branch of the United Steel Companies, Limited, for the design and construction of further extensions to its ore preparation and sinter plants. The order covers the supply of four additional sinter machines 8 ft. wide by 168 ft. long, together with the engineering of the complete plant. The total value of the contract is approximately £1,500,000.

The completion of this contract will bring the total number of sinter machines supplied and installed by Head Wrightson to Appleby-Frodingham to 10. It is expected that the new machines will be completely installed and operating at full capacity by the end of 1962.

Durham Cokemen Strike

MORE than 2,000 Durham cokemen who work at eight of the 11 NCB coke-oven plants in the county came out on unnofficial strike on Monday in support of their claim for a 5s. a shift wage increase for all grades. The strikers were told by union officials that if they stayed out talks with the NCB fixed for this week would be called off.

Mr. T. W. Tindale, secretary of the cokemen's union, revealed that the board had offered an increase of 11d. a shift, with an extra 1s. 2d. for craftsmen. About 600 workers at three old coke-oven plants continued normal working. Volunteer labour was used to keep the plants affected by the strike working to prevent them cooling down.

An official of the Northern Gas Board said it did not expect supplies to be affected by the strike.

Board Changes

WINGET, LIMITED—Gen. Sir William Duthie Morgan has joined the board.

LEYLAND MOTORS, LIMITED—Mr. W. E. Pearson has resigned from the board.

CEMENTATION COMPANY, LIMITED—Lord Tweedsmuir has been appointed a director.

ROYSTON INDUSTRIES, LIMITED—Lt-Cmdr. J. M. A. Parker (retd.) has joined the board.

LIGHTFOOT REFRIGERATION COMPANY, LIMITED—Sir Percy Sanders has resigned from the board.

A.B.C. COUPLER & ENGINEERING COMPANY, LIMITED—Mr. W. V. S. Sinclair has resumed as chairman.

LEESONA HOLT, LIMITED,—Mr. George Lee, joint deputy chairman and managing director, is to retire at the end of the year.

FAIREY ENGINEERING, LIMITED—Mr. G. C. Roberts has been appointed commercial director. He retains his chairmanship of E. & H. P. Smith, Limited, general engineers, of Birmingham.

DARLINGTON WIRE MILLS, LIMITED—Mr. J. L. Burbidge has resigned from the board and from those of the subsidiaries, Skerne Works, Limited, Northgate Steel Wire Mills, Limited, and Darlington Plastics, Limited.

GLENCAIRN METALS, LIMITED — Mr. William McIlwraith and Mr. Kenneth MacKenzie have joined the board. Mr. MacKenzie became general manager of the company a few months ago from the Lanarkshire Steel Company, Limited.

INTERNATIONAL MINERALS & CHEMICALS, LIMITED—Mr. William T. Bradley has been appointed a director. He will succeed Mr. Edward F. Perkins as managing director. Mr. Robert E. Ford has also joined the board.

BRITISH ALUMINIUM COMPANY, LIMITED—Lord Plowden (chairman), Sir Geoffrey Crowther, and Mr. H. F. R. Catherwood have been re-elected to the board, as have Mr. G. A. Anderson, Mr. E. F. O. Gascoigne, and Mr. J. Ritchie. Mr. L. B. Robinson, and Mr. R. G. H. Linzee have resigned their directorships.

Incandescent Heat Order for Gas Generators

CONTRACT worth approximately £55,000 for equipment to be installed in a Belgian steelworks has been received by the gas atmospheres division of the Incandescent Heat Company, Limited, Smethwick. It is for three gas generators, each producing 10,000 cu. ft./hr. of a nitrogen/hydrogen mixture. The plants will operate on coke-oven gas, but the design is equally suitable for town gas, propane, or butane.

The company has already supplied 67 nitrogen generators. The present contract will bring the number of those operating oversea to 19, which is nearly 30 per cent. of the total production.

FOLLOWING invitations from the Ministry of Labour to a number of industries to review the need for the wages councils with which they were concerned, it was announced on Tuesday that the Minister of Labour is to abolish the Tin Box Wages Council (Great Britain). This is the beginning of an expected move to reduce the number of wages councils, which at the end of last year numbered 63 and regulated the wages and conditions of about 3,500,000 workers.

NEWS IN BRIEF

STEEL PRODUCTION in the US this week is estimated by the American Iron and Steel Institute at 1,533,000 tons, compared with 1,547,000 tons (revised) last week.

PERMISSION has been granted by Kilmarnock Dean of Guild court for the erection of a new £95,000 factory extension for the Glacier Metal Company, Limited, at Kilmarnock.

PLANNING PERMISSION has been granted to Atcost (Factories), Limited, Tunbridge Wells, by Peterborough County Council to set up a new industrial estate, with light engineering works and warehouses, in First Drove, Fengate, Peterborough.

ALUMINIUM CASTING COMPANY, LIMITED, Greenock, is to close tomorrow (Saturday) with the resultant redundancy of the 50 foundrymen employed by the company. The premises have been acquired by David Adams & Company, Limited.

CLAIMED to be the largest in the Commonwealth, a 7,000-ton magnet has just been completed by Joseph Sankey & Sons, Limited, Wolverhampton. The magnet was built in 20-ton sections, which the company produced at the rate of one a day.

DURING the first 32 weeks of this year, 447,278 tons of iron-ore were imported through Hartlepool (Co. Durham), compared with 189,240 tons last year. During the same period, coal shipments fell by nearly 235,000 tons to 901,000 tons.

THE Electrical Engineers Exhibition at Earls Court will open for five days on March 21, 1961. Provisional space bookings have increased this year and over 460 of Britain's leading electrical manufacturers will show their latest developments to the trade.

GLASGOW FOUNDRY of David Rowan & Company, Limited, marine engineers, is to close at the end of October, to make way for an extension to the brass shop. The foundry employs 50 men, some of whom will be absorbed into other departments.

VERDICT of Accidental Death was recorded at the Newport inquest on Mr. William Ivor Davies (50), a labourer at the new Spencer steelworks of Richard Thomas & Baldwins, Limited, at Llanwern (Mon). While working in a 14-ft. deep pit he was crushed by a collapsing pile.

SOLE SELLING RIGHTS in the UK of the range of machine tools produced by the Gisholt Machine Company, Madison, Wisconsin, USA, and its associated subsidiary company, Gisholt Machine Company (Great Britain), Limited, have been assumed by Wickman, Limited, Coventry.

NEW COMPANY—J. C. Bamford (Exports), SA—has been formed by J. C. Bamford (Excavators), Limited, Rochester (Staffs). The new company has its head office in Lausanne, Switzerland, and will control all export sales, carry spares, and provide service for JCB equipment on the Continent.

ENGINEERING drawing office, planned to speed adaptation of American designs for power presses for use by its European manufacturers, has been established in London by the clearing division of US Industries. The new office is under the direction of Mr. A. Reitberger as chief engineer.

OF THE EMPLOYEES of W. P. Butterfield, Limited, manufacturers of transport and oil storage tanks, of Shipley (Yorks), 26 have a total of 575 years' service. The record goes to Mr. J. Threapleton, who joined the company at the age of 18 as a plater and has carried on this work for 45 years.

CONSUMPTION of fuel oil in the United Kingdom increased by 29 per cent. in the first half of this year to 8,860,000 tons from 6,870,000 tons in the first six months of 1959. Over a third of this consumption was used for electricity generation, where the fuel oil rate of increase was over 35 per cent.

TENDERS are soon to be invited by the Commonwealth Railways for the supply of new rolling stock worth £A400,000, Mr. H. Opperman, the Australian Federal Transport Minister, has announced. The order will include 28 high-speed passenger bogies, 40 steel flat wagons, and 40 open goods wagons.

OVERALL LEVELS of import and export prices in July were virtually unchanged from those in June, the import price index continuing at 98 (1954 equals 100) and that for exports at 111. The export price indices rose for each of the groups of manufactured goods, with the exception of engineering products.

RESEARCH LABORATORIES, costing about £125,000, are to be built in Wandsworth, London, by Morgan Crucible Company, Limited, which makes a range of industrial products from carbon, clay, and graphite materials. The new laboratories will be ready to start fundamental research work in about a year's time.

OFFICE MACHINERY exports in July were the highest this year, despite the fact that shipments for the seven months have been running at the record level of £16,200,000 compared with £12,100,000 in the same period for 1959. In July, £2,486,455-worth of machinery was exported, compared with £2,450,835-worth in July 1959.

SOUTH AFRICAN COAL production in the first half of the year, at 20,600,000 tons, was some 1,000,000 tons more than in the same period of 1959. The value of the 20,500,000 tons of coal sold during the half year was £13,400,000, compared with the 19,300,000 tons worth £12,000,000 sold in the first half of last year.

PENSIONS at twice the present rate are to be given to all male manual employees of Castrol, Limited, in the UK who are members, or who later become members, of one of the group's pension schemes. The company has also decided that all its employees in the UK shall participate in the Government's new graduated pension scheme.

MORE THAN half the equity capital of quoted companies is held by individuals and over 10 per cent. by insurance companies and pension funds, a study of share ownership published in the summer issue of the Stock Exchange Journal reveals. There are now about 2,000,000 shareholders in Britain, each with a stake in several different companies.

NOMINEE of the 6,000-strong Area representation of the National Union of Mineworkers for Labour candidate in the Ebbw Vale by-election is Ald. Frank Whatley. The British Iron and Steel and Kindred Trades Association has nominated Mr. Michael Foot as Labour candidate for the seat, which became vacant on the death of Mr. Aneurin Bevan.

UNDER a suggestions scheme run by the Morgan Crucible Company, Limited, Mr. James H. Fairweather (57), a laboratory assistant in the company's research department, has been awarded £225. His alteration to the cooling system of a laboratory furnace will save approximately 10,000,000 galls. of water a year, and represents an annual saving to the company of £400.

NOTICE was served on about 150 moulders and

labourers at the Whifflet foundry, Coatbridge (Lanarkshire), of R. B. Tennent, Limited, on Friday last. For some time now the men have banned overtime over a bonus dispute. The question of bonus for the whole company is under review and the men have been told that unless they conform to normal practice they must leave today (Friday).

EXPORTERS will have about 400,000 fewer forms to fill up from now on, according to a Treasury announcement on Thursday which abolished exchange control forms for export shipments of goods worth between £500 and £2,000, excluding private gifts. This represents over two-thirds of the present number of exchange control forms for exports to destinations outside the sterling area.

LICENSING AGREEMENT has been concluded between Jones Balers, Limited, agricultural machinery engineers, of Mold (Flintshire), and Allis Chalmers Manufacturing Company, of Wisconsin, US, under which the American company has exclusive licence to manufacture, use, and sell, throughout the US and Canada, balers of the Minor type incorporating the patents on them issued to Jones Balers.

EXPORT CONTROLS on about 70 items are to be abolished by the Indian Government, Mr. Lal Bahadur Shastri, the Minister of Commerce, has announced. The items include a number of chemicals, including calcium carbide; engineering goods such as electrical instruments; certain copper manufactures including wires, sheets, strips, and plates; lead alloys, rubber belting, and vessels for harbour and inland navigation.

DESPITE the seamen's strike, exports of iron and steel goods and chemicals from Middlesbrough in the four weeks ended August 14 maintained an all-round increase of 4,000 tons. Imports more than doubled during the period, the largest increase being in iron ore. At Hartlepool coal exports fell by over 30,000 tons to 65,300 tons, but imports of iron ore rose from 20,000 in the corresponding period of 1959 to 103,000 tons.

Ore Chartering

MOST of the major markets are quiet, and from many loading areas there appears to be a preponderance of tonnage to the extent that owners are having difficulty in maintaining the basis of last rates paid. Nevertheless owners are not disposed to fix far ahead.

The ore trades appear to be particularly quiet with Abou Zenima/Rotterdam reported at the low rate of 32s. 6d. for 10,000 tons, August 10/27, and manganese has been fixed from Poti to Antwerp-Hamburg at 31s. f.i.o.t. for 8,500 tons October shipment. Marmagoa/Trieste or Rijeka has taken a 10,000 tonner for late September at 37s. 6d. with free discharge, and from Port Elizabeth 9,200 tons has been fixed with manganese ore to Birkenhead at 46s. f.o.b. for middle of December. The only fixture reported from the Baltic is Vasteras to Tyne or Goole for about 800 tons magnetite, August 15/22, at 38s. f.i.o.t. West Africa Ore reports 18,000 tons for September onwards for two trips to Conakry Gdansk at 26s. f.i.o.

Phosphate from Casablanca to the UK shows a limited inquiry and recently 4,000 tons for prompt loading was fixed to Billinham at 40s. From Tampa two vessels, 12,000 tons and 9,500 tons, both for August, have been fixed to Japan at $7.65 and $7.50 respectively, both f.i.o. There is a fair miscellaneous selection of business quoting from the Mediterranean area generally to the UK and Continent.

Production of Iron Castings

PRODUCTION of iron castings in the second quarter of this year was 1,006,310 tons, which compares with 878,590 tons in the corresponding 1959 quarter. District production figures for April-June, 1960 (with the corresponding figures for last year in parentheses), were:—

Eastern, south-eastern (including London), southern, and south-western, 118,140 (108,460) tons; Midland, 221,010 (204,170) tons; north Midland, 213,390 (185,360) tons; East and West Ridings, 90,370 (84,500) tons; North-western, 96,460 (85,240) tons; Scotland and Northern Ireland, 93,240 (77,660) tons; Wales, 63,610 (54,310) tons.

Commenting on the Iron and Steel Board's production figures, the Joint Iron Council draws attention to the fact that the Easter and Whitsun holidays both fell in the second quarter this year, the effect being to reduce the number of working days by between 3 and 4 per cent. compared with the previous quarter. Taking this into account the daily rate of output in the second quarter was the same, or fractionally higher, than in the first quarter.

The steady rise in ironfounding production levelled off in the second quarter, the rate of output being well maintained at the same level as that of the previous quarter. The Joint Iron Council states that, with the exception of castings for railway equipment, output was lower in the second quarter of 1960 than in the first. When allowance is made for a reduction in the number of working days due to the incidence of holidays, however, it is evident that the daily rate of production in the automobile, the ingot mould, and the railway equipment section was slightly higher in the second quarter than in the first quarter; in the pressure pipe and engineering sections it was maintained, and in the building and domestic section only was it lower. For each section, production in the second quarter of 1960 was higher than in the second quarter of 1959, the improvement being most noticeable for ingot moulds and significantly large in the automobile, engineering, and pressure pipe sections.

The number employed in the ironfounding industry at the end of June, 1960, was 129,900, which was 400 more than three months earlier and 6,300 more than at the end of March, 1959.

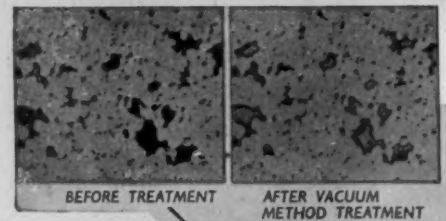
Lancashire Foundry Trade

THE demand for foundry pig-iron on the Lancashire markets during the past week, having regard to the fact that holiday stoppages continue to leave their mark on the movement of supplies from the furnaces, has been on a reasonably satisfactory scale. A good aggregate tonnage is being absorbed by the heavy electrical engineering trade, which has a substantial amount of foundry work in front of it, and the improvement in conditions in the textile machinery section and among machine-tool makers has been maintained. A number of other speciality foundries, including those assoicated with chemical plant manufacture, are steadily employed.

Between them, the jobbing and light castings foundries are taking up a fair aggregate tonnage of pig-iron. Derbyshire No. 3 is quoted for delivery in the Lancashire zone at £21 1s. 3d. per ton, with Staffordshire low-phosphorus iron at £23, and West Coast hematite at £25 16s.

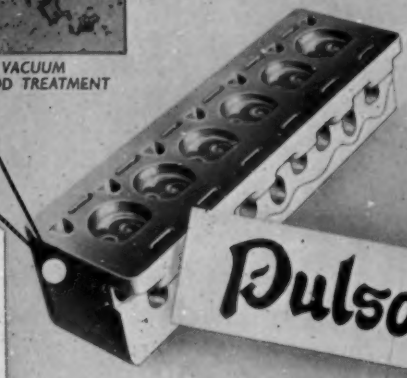
SEALING OF FERROUS & NON-FERROUS CASTINGS BY

Impregnation



BEFORE TREATMENT

AFTER VACUUM METHOD TREATMENT



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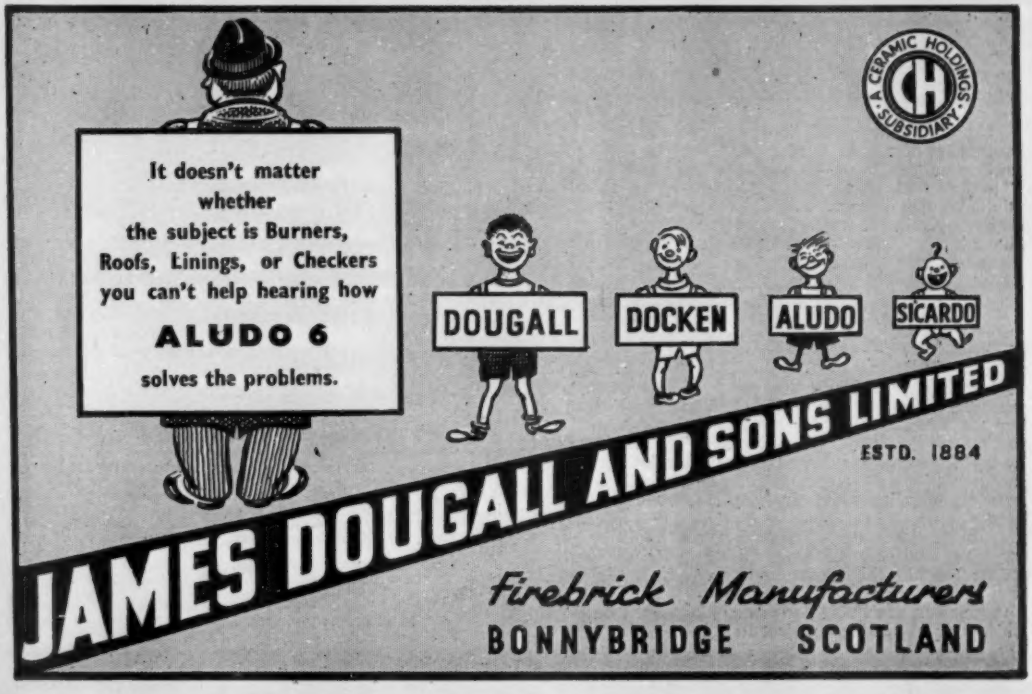
This process has been applied successfully to bronze, gunmetal, steel, aluminium and cast iron castings of all sizes at pressures up to 1,200 lb. per sq. in., thus saving production time, money and labour.

Vacuum Impregnation has been so perfected that castings can be sealed within 48 hours.

Descriptive details on request.



Apprentice of the Year Scheme Extended

THE British Apprentice of the Year Award Scheme, started four years ago, has been so successful that it is being extended. This year, instead of one apprentice being selected to visit Australia, three have been chosen and will be sent on travelling scholarships to Australia, West Germany, and the US. This was announced on Monday by the British Junior Chambers of Commerce, which operates the scheme.

Mr. M. Wilcox, president, said that a reciprocal scheme was operating with the Australian award and it was hoped soon to make similar arrangements with West Germany, the US, and Canada. Since 1956 four Australian apprentices had come to Britain and two Britons had gone to Australia. The apprentice worked during his stay abroad and received a wage.

The 1960 awards have been made to Mr. A. H. B. Fairlie, a technical apprentice with Babcock & Wilcox, Limited, Renfrew, who has already left for Australia, and to Mr. D. M. Rees, a craft apprentice of Goodfellow, Stevens, Limited, Dundee, who is leaving for West Germany in September. Mr. D. Allen, a commercial apprentice with Rubery Owen & Company, Limited, is to leave for the US this month.

"Cut-throat" Competition in the Foundry Trade

SEVERE competition in the foundry trade was referred to at a sitting of the Northern Area Licensing Authority for Goods Vehicles at Stockton-on-Tees recently. Supporting an application by Williamson (Haulage Contractors), Limited, for permission to use a flat-bed lorry and an articulated vehicle, Mr. A. Moore, manager of Harrison Bros. (England), Limited, said that unless a foundry could deliver goods ordered late in the afternoon on the following morning it might lose the contract. The practice of late ordering, he said, was becoming too prevalent.

Granting the application, the chairman of the authority, Mr. J. A. T. Hanlon, however, described the system as monstrous. It meant, he said, sending lorries "tearing through the night" when, with a little forethought, the customer could have obtained the goods easier by rail. It was a case of cut-throat competition, he said. If one firm refused to carry out the work, someone else would.

DRIVE AGAINST FACTORY ACCIDENTS

CAMPAIGN against untidiness in Britain's factories, a major factor in the cause of accidents, is the theme of National Industrial Safety Week organized by the Royal Society for the Prevention of Accidents, which begins on September 26. The society will stress the need for clearing away accident-producing accumulations of waste, litter, scrap metal and idle, rusting, derelict plant from yards, storerooms and workshops.

Aim is the elimination of hazards likely to cause slipping, bumping, tripping, falling and other dangers falling within the group known as the "Big Five," as listed by the Chief Inspector of Factories, which account for nearly 70 per cent. of accidents occurring in industrial premises subject to the Factories Acts.

Appointment of Members to Clean Air Council

ALL the initial appointments having expired, Mr. Henry Brooke, the Minister of Housing and Local Government, has appointed the following members of the Clean Air Council. Roughly one-third of the appointments will expire each year, some in 1961, some in 1962 and some in 1963. Those who have been appointed for periods ending in 1961 or 1962 were previously members of the council while those appointed until 1963 are new members.

Appointed until April 30, 1961: Sir Hugh Beaver, chairman, Arthur Guinness & Company, Limited; Mrs. D. M. Charlton, chairman, Women's Advisory Council on Solid Fuel; Sir John Charrington, chairman, National Federation of Coke Distributors Associations and vice-president, Coal Utilization Council; Mr. P. B. Dingle, Mr. R. S. MacTier, chairman of Technical committee, Liverpool Steam Ship Owners' Association; Cllr. F. V. Magness, Dr. S. W. Saunders, chairman of ICI (Heavy Organic Chemicals), Limited; Mr. C. M. Vignoles, managing director, Shell-Mex & B.P., Limited; and Mr. A. H. Wilson, deputy chairman and managing director in charge of research and development, Courtaulds, Limited.

Appointed until April 30, 1962: Ald. C. A. Bence, Cllr. J. A. Brown, Comdr. C. Buist, chairman, Low Temperature Coal Distillers Association of Great Britain, Limited and hon vice-president, National Union of Manufacturers; Sir John Eccles, deputy chairman, Central Electricity Authority; Lt.-Col. Lord Dudley Gordon, member of council and executive committee, British Iron and Steel Federation; Mr. K. W. C. Grand, member, British Transport Commission; Dr. W. A. MacFarlane, managing director of the National Industrial Fuel Efficiency Service; Dr. Llywelyn Roberts, medical officer of health, Sheffield; and Prof. M. W. Thring, Prof. of fuel technology and chemical engineering, University of Sheffield.

Appointed until April 30, 1963: Mr. Stanley E. Cohen, Mr. A. G. Dawtry, Mr. L. Eastwood, Mr. W. K. Hutchison, deputy chairman, Gas Board; Ald. Mrs. R. F. Isley, Mr. W. E. Jones, past president National Union of Mineworkers, and member of the General Council of the TUC; Mr. J. L. Lewis, member of executive, Coal Preparation Plant Manufacturers' Association and British Chemical Plant Manufacturers' Association; Cllr. Mrs. P. M. Mainwaring; and Dr. R. C. M. Pearson.

The council was established in 1957 to assist the Minister in keeping under review the progress made in abating the pollution of air in England and Wales. The Minister of Housing and Local Government is chairman, and the Parliamentary Secretary to the Ministry of Housing and Local Government, and the Parliamentary Secretary to the Ministry of Power are vice-chairmen.

Increases of Capital

TORVEX PEAT, LIMITED, Glastonbury, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £5,000.

GRADES METALS, LIMITED, London, E.C.4, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £50,000.

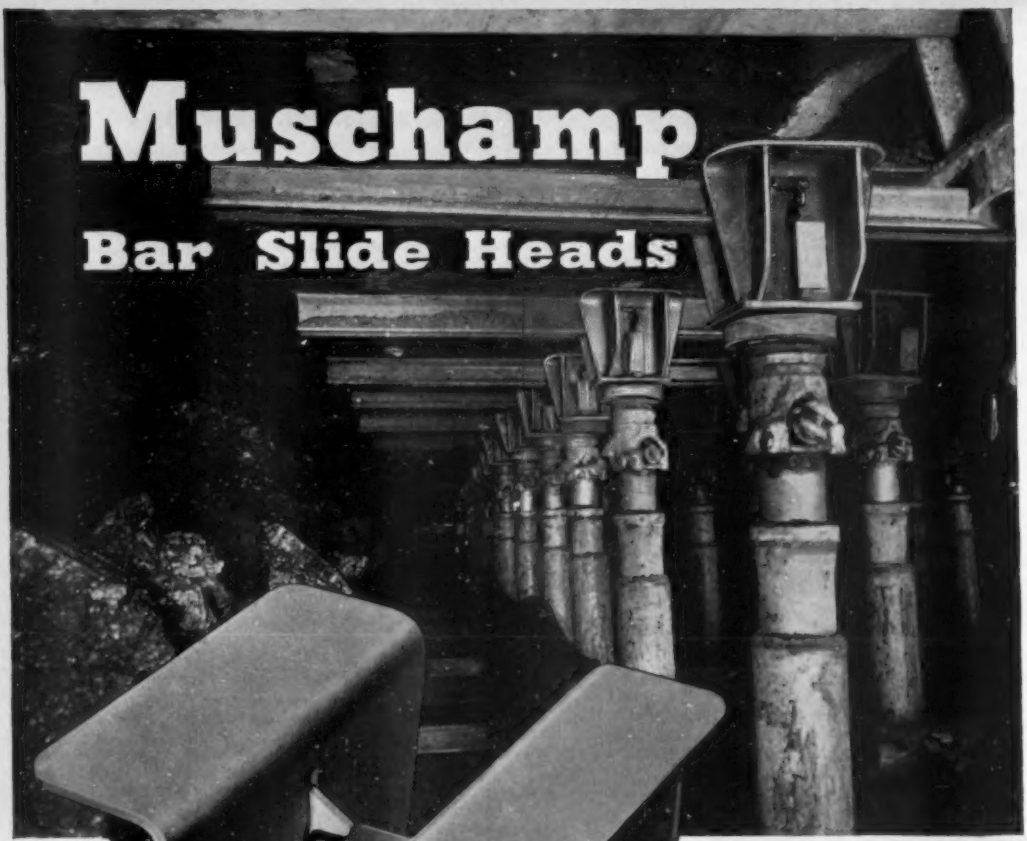
BRIGHTON SHEET METAL WORKS, LIMITED, Brighton, increased by £10,000, in £1 shares, beyond the registered capital of £10,000.

DOLLOSSE ENGINEERING, LIMITED, Blackburn, increased by £9,900 in £1 ordinary shares, beyond the registered capital of £100.

A. H. BLAND (ENGINEERS), LIMITED, Hayes (Middx), increased by £28,500, in £1 ordinary shares, beyond the registered capital of £1,500.

Muschamp

Bar Slide Heads



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£60,000,000 Oil Equipment Orders for UK Firms

ORDERS for equipment and materials to a total value of £60,628,000 were placed by oil companies with British firms during the first half of this year, according to figures published by the Council of British Manufacturers of Petroleum Equipment. This was slightly greater than the sum spent during the previous half-year, and about £4,000,000 higher than the total for the first six months of 1959.

About 60 per cent. of the equipment ordered in the latest half-year was for use oversea. Some of the principal categories of equipment, together with the quantity of orders placed in January-June of this year were: tubulars, pipe-fittings and valves (£5,782,000); specialized drilling and production equipment (£4,676,000); automotive equipment (£4,578,000); tools and machinery (£3,575,000). Other large items included drums, drumsheets and tinplate, boilers and associated plant, tankage and fitting and cleaning equipment, kerbside pumps and refinery apparatus.

As usual, the largest category of all was bulk chemicals—valued at £14,394,000.

Coventry Gauge & Tool Sales Subsidiary in Germany

THE Coventry Gauge & Tool Company, Limited, has formed its own sales organization in Western Germany under the name of Matrix G.m.b.H., with offices and showrooms located at Langen, near Frankfurt. A number of German sales engineers are at present at the company's main works at Coventry for preliminary training prior to the German Machine Tool Exhibition at Hanover in September at which Coventry Gauge & Tool is exhibiting.

The new German company will be concerned with the sale of Matrix machine tools, gauges and instruments, Thompson precision surface grinding machines and "US" multi-slide presses manufactured and sold by the associated company, Rockwell Machine Tool Company, Limited.

Good Prospects for EFCO

PROSPECTS for the current financial year of EFCO, Limited (formerly the Electric Furnace Company, Limited) are good, states Mr. D. F. Campbell, the chairman. During the first five months of 1960, he reports, the monthly value of orders received by the group was about 20 per cent. above last year's monthly average. This was somewhat dependent on the motor car trade, but other customers were widely distributed, which added stability to the group's operations.

The expansion of the three principal subsidiaries, said Mr. Campbell, had been remarkable. The value of orders received for the last six months of the financial year was the highest in their history and this satisfactory trend was being maintained. Reciprocal licensing arrangements with leading American and Continental manufacturers continued with complete goodwill.

Group net profit for the year ended March 31, 1960 was £152,890 (£156,061), and the dividend is raised by 2½ per cent. to 20 per cent.

The Scrap Markets

Stronger Demand for Steel Castings

North-East Coast.—Scrap imports into the area have been increased, largely through the industry's central purchasing organization. Shipments have arrived at Middlesbrough from Germany and North America, while at Sunderland, where scrap imports last year ceased entirely, the first US cargo of iron and steel scrap to arrive in the Wear for three years has added another 9,600 tons to supplies. This has not resulted in any diminution of specifications issued by the various works to local scrap merchants, who are under pressure to supply maximum tonnages of Nos. 1 and 2 qualities of the basic grades of steelmaking scrap. Incoming supplies are also being well maintained from south country ports and also from Ireland by coastwise vessels.

There has been an improvement in the demand by the engineering establishments for steel castings. Short heavy steel scrap for the foundries in in big demand and, although the recovery at the ironfoundries has not been so significant in this area as elsewhere, merchants note a slight improvement in the intake of cast-iron scrap locally. Stocks are also being cleared by transporting material to other areas where the demand for cast-iron material is better.

Blast-furnace outputs of basic pig-iron have increased considerably and so have their demands for steel turnings and baled scrap. Stocks now being maintained at works are fairly high, as an insurance against any possible interruption of transport facilities during the winter months.

Scotland.—The iron and steel scrap market in Glasgow and the West of Scotland is beginning to show some response in the way of tonnage figures to the efforts of the merchants since the resumption of work after the holidays. While day-to-day deliveries are not all that they might be, they do show some slight improvement, and are about average for this time of the year.

The steelworks are fully engaged in their efforts to keep pace with incoming orders and a high rate of production is being maintained; as a result, there is no slackening off in their requirements of steelmaking scrap, and merchants are doing everything in their power to provide the material required.

The production of steel turnings remains fairly constant, and regular supplies are going forward to the consuming works. The output of cast-iron borings is also steady, and reasonable deliveries are being made to the blast furnaces.

There is very little change to report at the ironfoundries. There has been a slightly better inquiry for the lighter grades, and these are readily filled in the various areas, but there is little or no demand for the heavier grades.

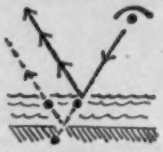
SINCE it was introduced about 10 months ago, a total of 50 outplating companies has joined the Mond Nickel Company, Limited, labelling scheme, and will supply world manufacturers with certified work, chromium plated to the required UK grade. The scheme was started with the object of raising the standard of chromium plating by ensuring that the correct thickness of protective nickel is included in the plating.

Electrical Aids in Industry *Data Sheet* **No. 13**

Infra-Red Heating

Infra-red heating is the name given to the method of using in industrial processes radiant heat from heaters specifically designed for that purpose. This differentiates it from methods employing both radiation and convection, as in furnaces, although the effect of the radiation is much the same in both cases.

Radiant heat provides a higher rate of heat transfer to bodies not highly reflective than does convection, unless high-velocity forced convection is used. The rate of heating of a body depends on the intensity of radiation on its surface, the proportion absorbed by the surface and, after that, on heat conduction. In heating very thin bodies, for example paint films, the radiation not reflected nor absorbed passes through and is in turn reflected or absorbed by the underlying material. This reflected heat is partly absorbed by the paint film "on the way back". Despite this effect infra-red gives mainly a surface heating effect except in the case of a few special applications.



Infra-red heaters mainly use metal-sheathed elements in special reflectors, but infra-red lamps with internal reflectors are still used in special cases. Other types use silica-sheathed elements or quartz-sheathed lamps in reflectors. A wide range of heaters is available with simple mounting arrangements to enable heat to be applied quickly and effectively either in a production line or in some odd corner.

Control of the charge temperature is effected by regulating the heating time and power. In the case of a moving charge, this is done by adjusting the conveyor speed and the number of heaters in circuit, i.e. by adjusting the effective length of the oven. Some of the heaters may be controlled by energy regulators or adjustable transformers.

The advantages of infra-red heating over convection heating include reduced heating times, reduced floor space, lower installation costs, almost instant starting, ability to focus the heat, and flexibility in effective oven length. Infra-red ovens can often be mounted in the roof, saving valuable floor space. Infra-red heating is not generally favourable for heating large bodies of low heat conductivity.

Paint Stoving

Many paints, particularly synthetic enamels, and including synthetic wood finishes, are well suited to infra-red heating, and many products ranging from small components to complete motor cars are being successfully stoved. Infra-red heating reduces stoving times very considerably and often improves the finish.

Moisture Extraction

Infra-red can provide high drying rates, either of liquid surface films or of thin absorbent materials. Sheathed element heaters usually give the highest rates, but lamps are sometimes used where the dried material is particularly heat-sensitive. Applications include such tasks as drying of paper and textile products, bottle seals and labels, clayware glazes and many others.

Plastics

Infra-red is widely used in the plastics and allied industries for such typical applications as softening and curing of plastic sheets and belts, heat setting of nylon and similar fabrics, drying and curing of plastic and rubber coatings and others where a plastic forms the whole or part of a product.

The above are just a few examples of successful applications of infra-red. In many other processes infra-red heaters can often be fitted quickly and cheaply, to save time, labour and floor space and, therefore, money.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London W.C.2. Telephone: TEMple Bar 9434.

Excellent reference books on electricity and productivity (8/6 each, or 9/- post free) are available—"Resistance Heating" is an example; "Induction and Dielectric Heating" is another.

E.D.A. also have available on free loan in the United Kingdom a series of films on the industrial uses of electricity. Ask for a catalogue.

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CURRENT PRICES OF IRON AND STEEL

(Delivered, unless otherwise stated)
September 1, 1960

PIG-IRON

Foundry and Forge Iron.—No. 3 iron, Class 2, Middlesbrough, £21 6s.; Birmingham, £20 18s. 3d., 10-ton lots or over.

Low-phosphorus Iron.—Over 0·10% to 0·40% P, 10-ton lots or over, £23 5s., delivered Birmingham, £23 10s., delivered Grangemouth.

Basic Pig-iron.—Delivered in Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics, 10-ton lots or over, £20 3s.

Hematite.—Si up to 2%, S & P 0·03-0·05%: N.-E. (local iron), £23 19s.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 7s. 6d.; Birmingham, £25 14s.; Wales (Welsh iron), £23 19s., 10-ton lots or over in each case.

Refined.—Cylinder and refined irons, South Zone £25 9s., North Zone £25 6s. 6d. Refined malleable, max. 0·10% P. South Zone £26 9s., North Zone £26 6s. 6d.

MANUFACTURED IRON

(Bar basis, 2½ in. to ¼ in.)

CROWN IRON: England and Wales (Zone 1), £48 10s.; Scotland, £48 5s.; Ireland, f.o.q. Belfast, £50 7s. 6d.; all other Northern Ireland ports, £50 10s., f.o.q. Cable iron, £1 extra.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., 100 tons and over, £31 15s. 6d.; tested, 0·08-0·33% C, 6 to 35 tons, £33 15s. 6d.; hard (0·41-0·60% C), under 10 tons, £34 17s.; silico-manganese, under 10 tons, £43 16s. 6d.; free-cutting steel up to 0·25% C, under 10 tons, £36 14s. 6d. SIEMENS-MARTIN ACID (under 10 tons): Up to 0·25% C, £41 1s.; silico-manganese, £44 4s.

Billets, Blooms, and Slabs for Forging and Stamping.—Lots of under 10 tons. Basic, soft, up to 0·33% C, £38 10s.; basic, hard, over 0·41 up to 0·60% C, £39 12s. 6d.; acid, up to 0·25% C, £43 4s.; acid silico-manganese, £46 7s.

Alloy Steel (5 tons to under 10 tons).—BILLETS, 3 in., up to and including 10 in., for re-rolling, 0·6/1% Ni, £47.; Ni 2·75/3·75%, Cr 0·5/1·10%, £73 17s.; Ni 2·75/3·75%, Cr 0·5/1·3%, Mo 0·2/0·65%, £84 7s. BARS: 1 in. dia. and up, nickel, £67 17s.; nickel-chrome, £98 11s.; nickel-chrome-molybdenum, £111 4s.

Other Semi-products, etc.—Forging ingots, up to 0·60% C, £31 12s. 6d. f.o.t.; tube billets, under 10 tons, £40 10s.; shell steel billets for direct forging up to and including 0·33% C, 100 tons and over, £37 15s.; tin bars and sheet bars, 50 tons and over, £32 10s. Wire rods, 3g. to 4g. (all areas except Birmingham, Scotland, Southern Joint Area, and Northern Ireland): Soft basic, under 50 tons, £41 2s.; hard basic, under 10 tons, £44 8s.; free-cutting, up to 0·25% C, under 10 tons, £46 12s.; acid, up to 0·75% C, under 10 tons, £54 14s. 6d. Stainless steel billets, 3 in. and over, 5 tons to under 10 tons, Austenitic, £229 10s.; martensitic, £141 10s.

FINISHED STEEL

Heavy Products (1 ton to under 10 tons).—Mild-steel plates, ordinary qualities, N.-E. Coast and Northern Joint Areas and Central Scotland, £41 12s.; medium plates, all areas of England and Wales, £45 1s. 6d.; boiler plates, N.-E. Coast and Northern Joint Areas and Central Scotland, £44 2s.; floor plates, N.-E. Coast, £43 1s. Sections (N.-E. Coast, Midland, and Northern Joint Areas, and Central Scotland): Angles, £38 16s. 6d.; bars (rounds and squares), £41 6s. 6d.; flats, £39 1s. 6d.; joists, £38 12s. 6d.

Rolled and Re-rolled Steel Products.—N.-E. Coast, Midland, Northern Joint, and South Wales Areas, and Central Scotland, 50 tons and over: Angles and tees, 4 in. and under, £40 18s. Channels, 3-in. web and under, £40 18s. Flats, 5 in. wide and under, and rounds and squares, under 3 in.: Untested soft basic, £39 1s.; free-cutting, £45 1s. 6d.; hard basic, £41 19s. 6d.; Siemens-Martin acid, £49 0s. 6d.; spring steel, basic, £44 4s. 6d., spring steel, acid, £52 19s. Glazing tees, £47 0s. 6d. Sash and casement sections, £43 13s. 6d. Gate channels, £50 17s. 6d. Ferro-concrete bars (10 tons to under 500 tons), £39 10s.

Sheets and Strip.—Uncoated strip mill coils, hot rolled, under 3 mm. to 12g., mill run, mill edge, 25 tons to under 50 tons, £43 16s.; cold reduced, 17/20g., side trimmed, skin passed, £49 16s. Black sheets, 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £68 5s. Cold-rolled steel strip, coils, hard temper, not annealed, 10 tons to under 20 tons, £55 5s. Hot-rolled hoop and strip, u/t soft basic, 100 tons and over, £38.

Tinplates.—Cold reduced, hot dipped, 15 tons to under 50 tons, 66s. 8d. per basis box of 108 lb., f.o.t. makers' works. Cold reduced electrolytic, 59s. 9d. per basis box.

Colliery Rails and Arches.—Arches, 4 in. × 2½ in. × 2 in., re-rolled £39 15s., 3 in. × 3 in., re-rolled £40, 3½ in. × 3½ in., re-rolled £40 7s. 6d., 4 in. × 2½ in. × 2 in., prime £44 6s. 9d. Other sections, prime £44 11s. 9d. Extra fishplates, £52 10s. Cambered girders, 4 in. × 2½ in. × 2 in., re-rolled £38 9s., 3 in. × 3 in., re-rolled £38 11s. 6d., 3½ in. × 3½ in., re-rolled £38 18s. 6d., 4 in. × 2½ in. × 2 in., prime £43 4s. Other sections, prime £43 6s. 6d. Bank bars, standard type, prime material, all thicknesses, £38 11s.; re-rolled, up to ¾ in., inclusive, £37 6s.; over ¾ in., £38 11s. "W" type bars, prime steel, all thicknesses, £41 1s.; re-rolled, up to ¾ in., inclusive, £39 16s.; over ¾ in., £41 1s.

Bright Steel (10 tons to under 20 tons).—Bars, no analysis or test, £52 8s. 6d.; flats, untested, £70 3s. 6d.

High-speed Tool Steel.—Finished bars, 5% cobalt, 10s. 10d.; 14% tungsten, 6s. 11d.; 18% tungsten, 7s. 9d.; 22% tungsten, 9s. 2d.; 4/6 quality molybdenum tungsten, 6s. 3d.; 6/6 quality molybdenum tungsten, 6s. 5d.; 5/6/2 quality molybdenum tungsten vanadium, 6s. 7d. per lb.

Rails, etc.—F.B. rails, heavy, 75 lb. to under 90 lb., 500 tons and over, f.o.t., £39 15s.; fishplates for rails 80 lb. and over, 50 tons and over, f.o.t., £53 11s.; soleplates, f.o.t., 100 tons and over, £51. Light flange rails, 25 lb. and under, d/d N.-E. Coast, Midland, Northern Joint, and South Wales Areas, and Central Scotland, 50 tons and over, £40 17s. 6d.; fishplates for light rails, 50 tons and over, £50 12s. 6d.

BLAST-FURNACE COKE

(F.O.T. at Ovens)

DURHAM AND NORTH-EAST COAST: 159s. 3d. SOUTH WALES: 158s. NOTTS AND DERBY: 135s. 5d. LANCASHIRE: 146s. STAFFORDSHIRE: 139s. 5d. YORKSHIRE: 138s. 8d. SCOTLAND: 169s. 4d.

(All prices are subject to quality differentials.)

STEELWORKS SCRAP

(Plus 5 per cent. in the case of sales by merchants.)

	Scotland.	N.-E. Coast.	Midlands.	Sheffield.	Lancs.	S. Wales (East)	S. Wales (West)
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Heavy steel scrap* ..	229 3	228 3	220 0	226 3	226 3	227 3	232 3
Heavy mixed scrap*	207 3	206 3	198 6	204 3	203 9	205 3	210 3
Heavy steel turnings†	179 9	179 9	169 9	176 9	174 3	177 0	180 0
Heavy cast iron†	206 9	203 9	208 0	204 3	189 3	199 3	205 9
Cast-iron borings†	160 3	157 3	157 0	159 9	157 3	159 6	164 6

* Basis 500-ton lots in England and Wales and 250 tons and upwards in Scotland, delivered.
† Not less than 250 tons in England and Wales, 100 tons in Scotland.